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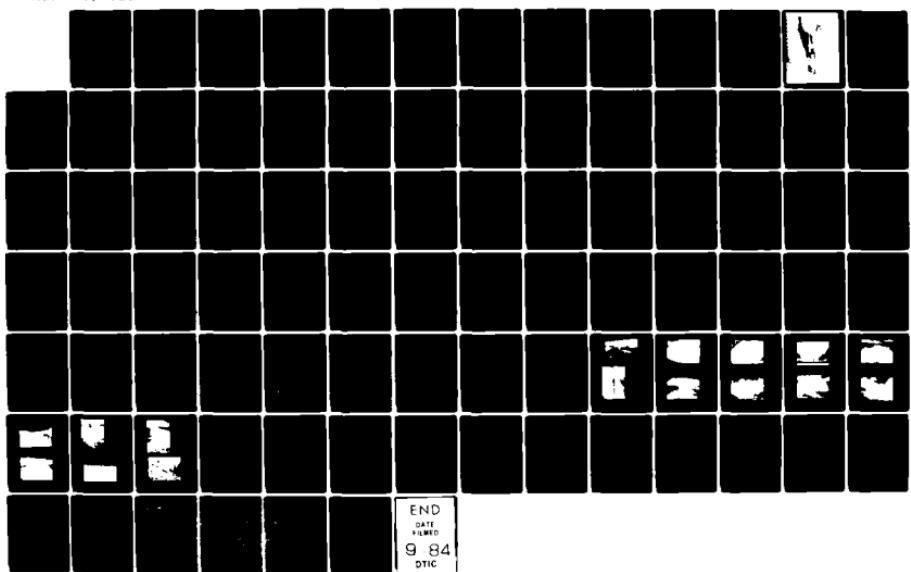
NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS  
LAKE TROHUNTA (MA 0001) (U) CORPS OF ENGINEERS WALTHAM  
MA NEW ENGLAND DIV MAR 79

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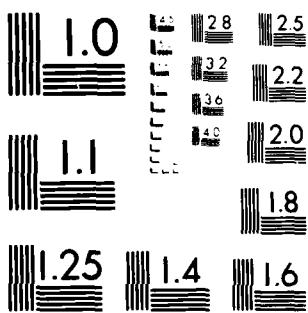
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CONNECTICUT RIVER BASIN  
ATHOL, MASSACHUSETTS

LAKE ROHUNTA

MA 00012

PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY  
NEW ENGLAND DIVISION, CORPS OF ENGINEERS  
WALTHAM, MASS. 02154

MARCH 1979

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam consists of a central 46 foot wide concrete spillway flanked by earthen embankments. The western embankment has a length of 250 feet and the eastern embankment has a length of about 280 feet. The dam has a size classification of intermediate and a hazard classification of low. According to the Corps of Engineers, the test flood is $\frac{1}{2}$ the PMF. The dam is in generally good condition. It is felt, however, that certain items which are generally normal maintenance and operational procedures need attention.		

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA 00012

Name of Dam: Lake Rohunta

City: Athol

County and State: Worcester County, Massachusetts

Stream: Branch Brook

Date of Inspection: November 14, 1978

The dam consists of a central 46 foot wide concrete spillway flanked by earthen embankments. The western embankment has a length of 250 feet and the eastern embankment has a length of about 280 feet. The spillway has a height of about 15 feet topped by a series of 6 foot high sluice gates with provisions for an additional 2 feet of flashboards. The dam contains 3 outlet pipes. The dam was originally constructed in 1909 and rebuilt in 1943 due to damage from the 1938 flood. Its present purpose is for recreation. It had been used for power generation until 1968. The dam is owned, operated and maintained by the Rodney Hunt Machine Company of Orange, Massachusetts.

The visual inspection did not disclose any findings that indicate an immediate unsafe condition.

The dam has a size classification of intermediate and a hazard classification of low. According to Corps guidelines,

the test flood is one half the probable maximum flood. The spillway is capable of passing 12 percent of the 6000 cfs test flood outflow. The dam would be overtopped by almost 3 feet.

This dam is in generally good condition. It is felt, however, that certain items which are generally normal maintenance and operational procedures need attention. These include repair of eroded areas on the upstream slope; removal of all trees and brush on the up and downstream slopes; monitoring of seeps at the base of the downstream masonry wall and at the exit of the 4 foot diameter outlet pipe; and to insure that the sluice gates and 36 inch draw down pipe are operational.

It is recommended that the owner insure that the abandoned 4 foot diameter outlet pipe is not under pressure at the toe and that the possibility of a flood overtopping the dam be further evaluated by a competent engineer. Furthermore, it is recommended that the owner maintain the lake at a lower level at all times and establish a standard operational procedure for raising the spillway gates and opening the 36 inch draw down during periods of high precipitation.

The above areas of concern should be accomplished by the owner within 2 years after receipt of this Phase I Inspection Report.



*Ronald H. Cheney*  
Ronald H. Cheney, P.E.  
Associate

Hayden, Harding & Buchanan, Inc.  
Boston, Massachusetts

Lake Rohunta

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Inspections. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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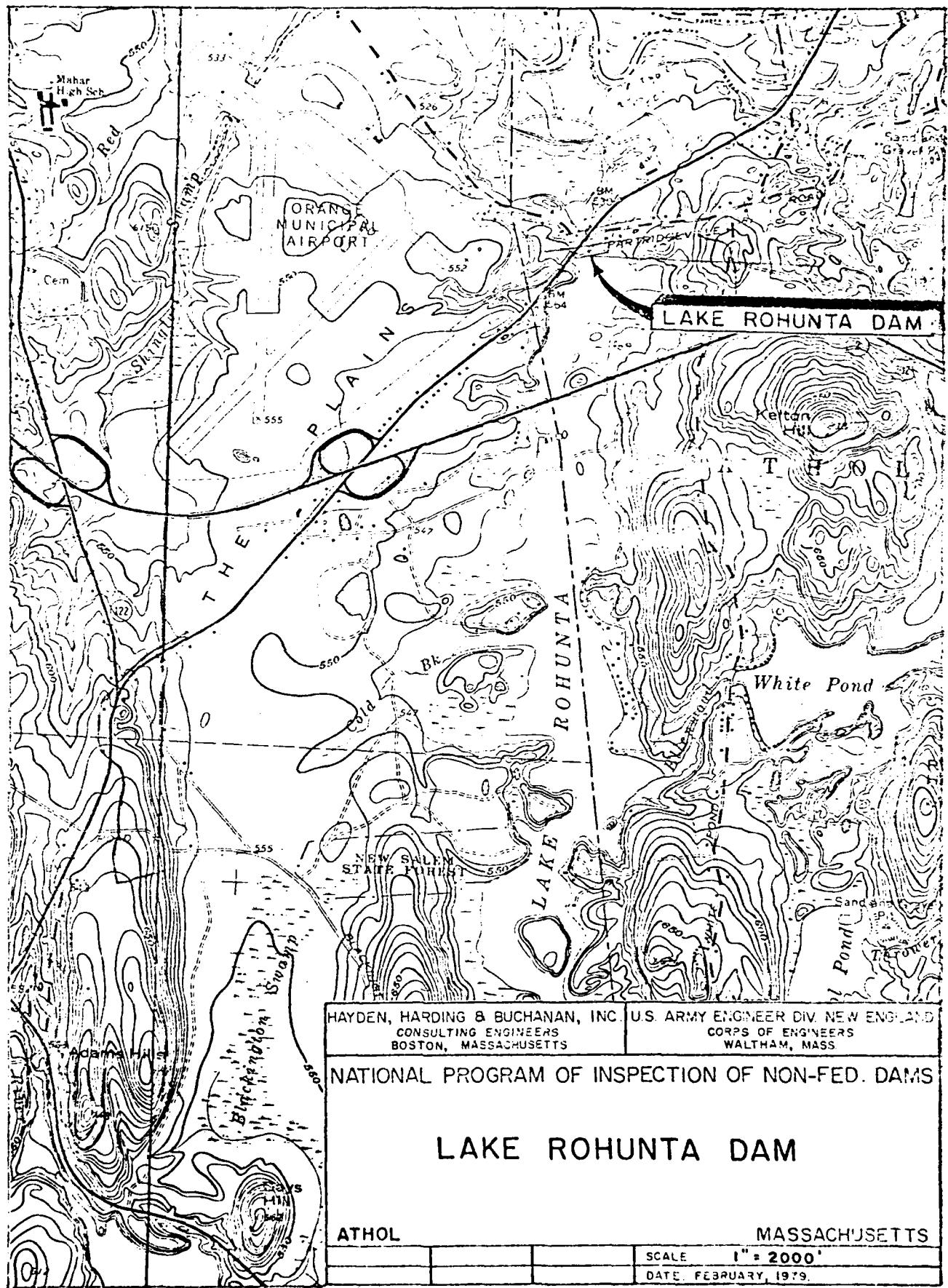
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PHASE I  
NATIONAL DAM INSPECTION PROGRAM  
NAME OF DAM: LAKE ROHUNTA

SECTION 1  
PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Hayden, Harding & Buchanan, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued Hayden, Harding & Buchanan, Inc. under a letter of 28 November 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW 33-79-C-0012 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

The dam, Lake Rohunta, is located in the Town of Athol, in Worcester County, Massachusetts. The actual lake is located within the Massachusetts towns of Orange, New Salem, and Athol. The lake is fed primarily by Riceville Brook and Ellinwood Brook. The dam is shown on the Orange Quadrangle with coordinates approximately at North 42°34'06", West 72°16'18".

b. Description of Dam and Appurtenances

The dam consists of a central 46 foot wide concrete spillway flanked by earthen embankments. The embankment contains a concrete and compacted clay core surrounded by earth fill having an eight foot wide crest, and side slopes on a 2 horizontal to 1 vertical slope. The upstream face

is lined with stone riprap on the upper portion. The western embankment has a length of approximately 250 feet and the eastern embankment has a length of approximately 280 feet. The spillway has a height of about 15 feet and utilizes portions of a previous spillway. A series of six foot high wood sluice gates with provisions for an additional two feet of stop logs are located above the spillway. A steel framed wood planked bridge services the spillway. The dam contains three outlet pipes. There is a 36-inch diameter outlet pipe located within the spillway. The gate for this outlet is located on the service bridge, but has not been operated in about 8 years. The other outlet pipes consist of a five foot inside diameter penstock located within the eastern embankment and a four foot diameter metal penstock located within the western embankment. The five foot diameter penstock has not been used in about 10 years. The 4 foot diameter penstock has not been used in several years and has been sealed with a metal plate at its exit at the downstream toe. It is also sealed by means of a gate valve located about 8 feet upstream of the exit. Remains of a hydraulic laboratory are located downstream of the four foot diameter penstock exit. The five foot diameter penstock feeds a test house located on the other side of the state highway some  $350\pm$  feet downstream of the dam. This structure contains provisions for power generation which have not been used in about 10 years.

c. Size Classification

The dam is classified as intermediate according to its storage capacity of 2420 acre feet. -3- Lake Rohunta

d. Hazard Classification

The hazard classification of this dam is low. A highway bridge below the dam could be overtopped and one building could suffer minor damages during flooding from failure of the dam. Loss of life would be unlikely.

e. Ownership

The dam has always been owned by the Rodney Hunt Machine Company of Orange, Massachusetts.

f. Operator

The dam is maintained and operated by Mr. John Wise of the Rodney Hunt Machine Company, Mill Street, Orange, Massachusetts, 01364. Telephone (617) 544-2511.

g. Purpose of Dam

The major purpose of the dam is to control the water level of Lake Rohunta for recreation. Earlier uses included hydropower experimentation and generation.

h. Design and Construction History

Plans filed with the Worcester County Commissioner's office in 1908 outlines the design of the original dam at this location. Construction of this dam was completed in 1909. The 1938 flood overtopped the original dam causing extensive damage. Final plans for a remodeled dam were filed with the County Commissioner's office in 1943. Construction of the existing dam utilized portions of the original core wall and concrete spillway. Construction was completed in 1943.

i. Normal Operating Procedures

There is no formal operational procedure for the dam. Normal operational procedures consists of placing 2 feet of of flashboard on top of the sluice gates during the late spring. These flashboards are removed during the late fall. Operation of the sluice gates and penstocks has not been attempted during the last 8 or 10 years

### 1.3 Pertinent Data

#### a. Drainage Area

The drainage area (12,992 acres - 20.3 s.m.) is comprised of wooded hills, containing several drainage paths and a number of ponds. There are two major drainage paths into Lake Rohunta. The first runs along Ellinwood Brook into White Pond, and then flows 2,000 feet and a fall of about 27 feet from White Pond into the central portion of Lake Rohunta. The other major drainage path flows through several ponds, along Riceville Brook, across South Athol Pond, and finally into the southern end of Lake Rohunta. Between this pond and Lake Rohunta, an elevation drop of about 20 feet occurs over a length of nearly 3,300 feet. Lake Rohunta is divided into three sections by dikes with culverts through them. Its overall length is approximately 15,400 feet.

There are few buildings and homes located within the drainage area. Some development occurs near Athol, South Athol, around White Pond and Lake Rohunta, and along New Sherborn and Petersham Roads. Several State highways and a number of secondary roads service the area.

Several buildings and a road bridge are located within 300 feet of the discharge stream below the Lake Rohunta Dam. Beyond the first 500 feet downstream no additional development occurs until after its confluence with the Millers River.

b. Discharge at Dam Site

The outlet works for this dam consist of a four foot diameter metal penstock within the western embankment, a five foot diameter metal penstock within the eastern embankment, and a 36 inch diameter waste pipe within the spillway. The four foot penstock, with an invert of 521.1+, has its gate closed, has been sealed with a steel plate at its downstream outlet, and is no longer used. The five foot penstock, which is closed and has not been used during the last ten years, runs into the generating structure approximately 350 feet downstream of the dam. Its invert is at elevation 516.3+. The 36 inch waste pipe has an invert at 514.8+, and can discharge onto the spillway apron downstream of its crest. This pipe remains in use, but has not been operated in about 8 years.

The original dam at this site was constructed in 1908 to 1909. During the 1938 flood, this dam was overtopped causing extensive damage. Using R. Hunts calculations, the 1938 flood was estimated to be approximately 2932 cfs. The current existing dam, which utilized portions of the original dam, was completed in 1943. Discharge records of the U.S.G.S. gaging station no. 1-1653 located about 600 feet downstream of the dam are available from 1964 to the present. The maximum discharge recorded at this gage was 496 cfs on June 29, 1972.

There are eight 6.2 foot by 5.8 foot wooden sluice gates located in bays atop the spillway. In normal operation these gates are in the down position, occassionally with stop logs on top of them. The gates can be raised manually to lower the lake, although they have not been used in the last eight years. With the gates down, the spillway capacity would be 723 cfs at elevation 532.7± (the top of the dam). Under normal operations, with the gates closed and a layer of stop logs on, the lake elevation would be about 530±. For the  $\frac{1}{2}$  PMF test flood conditions, the spillway flow capacity would be 570 cfs out of a total flow of 6000 cfs at elevation 535 feet, with the gates down.

c. Elevation (ft. above MSL)

(1)	Streambed at centerline of dam -----	515±
(2)	Maximum tailwater -----	523±
(3)	Upstream portal invert diversion tunnel -----	none
(4)	Recreation pool -----	530±
(5)	Full flood control pool -----	N/A
(6)	Spillway Crest (gated)-- top of sluice gates -	527.9±
(7)	Design surcharge (Original Design)-----	532±
(8)	Top Dam -----	532.7±
(9)	Test flood design surcharge -----	535±

d. Reservoir

- (1) Length of maximum pool ----- (1/2 PMF) --- 16,300+'
- (2) Length of recreation pool ----- 15,400+'
- (3) Length of flood control pool----- N/A

e. Storage (acre-feet)

- (1) Spillway crest pool ----- 900+
- (2) Recreation pool ----- 1,555
- (3) Top of Dam ----- 2,420
- (4) Flood-control pool----- N/A
- (5) Test flood pool ----- 3,533

f. Reservoir Surface (acres)

- (1) Spillway crest ---( top of sluice gates)--- 312+
- (2) Recreation pool ----- 315
- (3) Top dam ----- 350
- (4) Flood-control pool ----- N/A
- (5) Test flood pool ----- 465

g. Dam

- (1) Type ----- gravity, earth embankment
- (2) Length---- including spillway ----- 576'
- (3) Height --- to bottom of spillway foundation - 26+'
- (4) Top Width ----- 8'
- (5) Side Slopes ----- 2:1 riprap U.S., 2:1 turfed D.S.
- (6) Zoning---- Most impervious fill on U.S. side;  
Compacted clay at core wall; less impervious fill  
on D.S. side

- (7) Impervious Core --- Concrete & compacted clay core
- (8) Cutoff ----- none
- (9) Grout Curtain ----- none
- (10) Other ----- none

h. Diversion and Regulating Tunnel

none

i. Spillway

- (1) Type ----- Broadcrest, concrete ogee
- (2) Length of weir ----- 46'
- (3) Crest elevation ----- 521.9+
- (4) Gates ----- 8 -- 6.2' X 5.8' wooden sluice gates
- (5) U/S Channel ----- none
- (6) D/S Channel --- Natural stream bed; some small trees on embankment; free flowing

j. Regulating Outlets

The regulating outlets for this dam consist of a four foot diameter penstock, a five foot diameter penstock, and a 36 inch waste pipe. The invert elevation for each outlet is as follows: 4' diameter penstock- 521.1'±; 5' diameter penstock- 516.3'±; and 36" diameter waste pipe- 514.8'±. As previously stated, none of these facilities have been used in several years. All outlets were originally manually controlled. In addition, there are eight wooden sluice gates located in bays on the spillway crest. These gates are manually controlled and have not been used in about 8 years.

The crest invert and bottom of gates are located at elevation 522±.

SECTION 2  
ENGINEERING DATA

2.1 Design

Plans for the original dam built at the site location are dated 1908. This dam was overtopped in 1936 and 1938. Major damage occurred in 1938. Subsequent plans for a remodeled dam utilizing portions of the original structure were filed with the Worcester County Commissioner's Office in 1939 and 1943. Both of these sets of plans indicate the Rodney Hunt Machine Company to be the engineer. The existing structure followed the design outlined on the 1943 plans. Rodney Hunt hydraulic calculations which appear to be associated with the 1943 design were also located at the Worcester County Court House.

2.2 Construction

No construction data was discovered regarding Lake Rohunta Dam.

2.3 Operation

No written operational manual was discovered for this dam.

2.4 Evaluation

a. Availability

The 1908, 1939 and 1943 Design Plans were made

available at the Worcester County Court House, Engineering Department, Worcester, Massachusetts. Past County Inspection Reports, a County fact sheet, Rodney Hunt hydraulic calculations, and some correspondence were also located at the Engineering Dept. office. A letter of correspondence establishing the ownership of the dam was made available at the Department of Environmental Quality Engineering, Division of Waterways Boston office.

b. Adequacy

The lack of indepth engineering design data does not allow for a definitive review. Therefore the adequacy of this dam, structurally and hydraulically, can not be assessed from the standpoint of review of design calculations, but must be based primarily on the visual inspection, past performance history, and hydrologic and hydraulic assumptions.

c. Validity

The field investigation indicated that the external features substantially agree with those shown on the 1943 design plan.

SECTION 3  
VISUAL INSPECTION

3.1 Findings

a. General

The dam, Lake Rohunta, was inspected on November 14, 1978. At that time, water was passing over the spillway sluice gates approximately one inch deep. The upstream face of the dam could only be inspected above this water surface.

b. Dam

The dam consists of an earth embankment about 525 feet long with a concrete spillway in approximately the center of the embankment. The central 300 foot long section of the dam has a concrete core wall. The top of the core wall near the left abutment is shown in photo 2. The crest of the dam is about 25 feet above the river bed. The present dam was built in 1943 to replace a dam which had been washed out.

Visual inspection of the dam indicated it is in good condition.

Upstream Slope

The upstream face of the dam is sloped at about 2H:1V. The top 6 feet of the upstream slope was above the reservoir water level and available for inspection. Riprap slope protection generally extended from the water surface to within one or two feet of the crest of the dam, photos 4 and 15. Minor sloughing of soil above the riprap was observed. The riprap was in good condition.

Above the riprap, the surface is covered with grass and weed growth.

Crest

The crest of the dam, which is 8 feet wide, is grass covered, photo 1. No evidence of cracking or misalignment of the crest or of the spillway that could be attributed to embankment movement was observed.

Downstream Slope

The face of the downstream slope is generally covered with grass except at the right and left sides of the spillway where brush and trees with trunk diameters of about 6 inches were observed. A wet area was observed at the downstream toe in an area to the right of the spillway. This area, which is a topographical low and is about 65 feet square in size, can be seen in photos 3 and 9. A concrete box containing water pipes is located at one side of the wet area. The box had drainage holes in its bottom and most of the water flowing in the wet area appears to originate at the concrete box. The source of water in this box is not known. The concrete box can be seen in photos 3 and 9.

The foundation of a formerly existing hydraulic laboratory is located at the downstream toe to the left of the spillway. The toe of the dam has a vertical face of 5 to 7 feet in this area and is supported by a

masonry wall and a concrete wall which is a remnant of the laboratory, photo 5 and 6. An abandoned 48-inch diameter penstock passes through the dam and exits through the laboratory wall. Minor seepage was observed at the base of the concrete wall directly below the pipe, photo 7 and 16, respectively. No seepage was observed at the masonry wall.

c. Appurtenant Structures

Spillway

The spillway is a gravity concrete structure with eight gates that extend about 6 feet above the spillway crest, photo 14. Water was spilling over the face of the sluice gates at the time of inspection and the foundation and face of this structure could not be observed.

Training Walls

The right training wall is a combination concrete and masonry structure, photo 8, which reflects the rebuilding that occurred in 1943. Minor seepage of water was observed at the downstream toe of the concrete and can be identified in the photo as tan-colored streaks. The masonry portion of the right training wall is cracked and seepage can be observed near the base of the wall, which is the rust-stained area in photo 8. Water is exiting from several small diameter pipes which pass through the wall, which may be associated with a gate structure on the crest immediately adjacent to the right training wall. The left training wall is constructed

entirely with concrete, photo 10. This wall is in good condition and no seepage through the wall was observed.

The gate structure referred to above controlled the flow of water for the 5' diameter penstock, shown in photo 9. No seepage adjacent to the penstock was observed.

#### Outlet Pipes

There are three outlet pipes located within the dam. The 5 foot diameter penstock located at the right abutment area has not been operated in 8 years, photo 3. It appears to be in good condition, however, only by using the apparatus can its effectiveness be evaluated. The central 3 foot diameter pipe located within the spillway contains a gate which can be operated from the service bridge. This gate also has not been operated in several years. The 4 foot diameter old wheel building outlet located at the left embankment has its gate closed. A metal plate seals the downstream exit of this pipe. A closed gate is located approximately 8 feet upstream of this plate. Minor seepage was observed coming from the abandoned pipe and at the base of the concrete wall directly below the pipe, photo 7 and 16, respectively.

#### Service Bridge

The service bridge spans the spillway. It is a steel frame bridge with wood plank deck and handrails, photo 13. The handrails and deck were observed to be in good condition. The steel showed some rust but is in good condition.

d. Reservoir Area

The general area surrounding the reservoir is wooded and relatively flat. A more detailed description of the drainage area is included in Section 1.3a of this report. The amount of siltation within the reservoir is unknown.

e. Downstream Channel

The downstream channel is a natural river bed. The slopes are rock lined with some small vegetation. Some large boulders or outcrops were observed at the channel floor, however, they pose no blockage problem. Located approximately 300 feet downstream of the dam is a roadway bridge which spans the channel.

3.2 Evaluation

Visual inspection indicates the dam is in good condition. Minor seepage was observed at the base of the right training wall of the spillway, see photo 8. Minor seepage was observed where the embankment at the abandoned penstock to the left of the spillway exits the embankment at the concrete foundation wall. This condition is shown in photo 16. The 3 outlet pipes have not been operated in several years.

SECTION 4  
OPERATIONAL PROCEDURES

4.1 Procedure

The original purpose of the dam was power generation. This is no longer the case. Water retained by the dam is now utilized primarily for recreation. During the late spring, approximately two feet of flashboard is installed on top of the sluice gates to raise the water level of the lake. During the late fall, these flashboards are removed. No attempt has been made to operate the three outlet pipes for several years.

4.2 Maintenance of Dam

The general maintenance of the dam is performed by the Rodney Hunt Machine Company of Orange, Massachusetts.

4.3 Maintenance of Operating Facilities

The guides used in installing the flashboards are used twice a year. The three outlet pipes and the sluice gates have not been used in several years. There is no formal operational procedure for this facility.

4.4 Description of Warning Systems

There are no warning systems in effect at this facility.

#### 4.5 Evaluation

There is no formal maintenance procedure for this dam. However, the dam and all appurtenance structures appear to be well maintained. The outlet structures should be periodically operated to evaluate their condition. The dam should be inspected every two years by qualified personnel who can identify conditions of concern which if left unchecked could jeopardize the safety of the dam.

SECTION 5  
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General

The outlet for Lake Rohunta consists of an earth embankment dam with a 46 foot overflow spillway. This dam is basically a storage type project used to maintain the water level at elevation 530± on the lake for recreational purposes. Sluice gates, which are normally closed, and varying heights of stop logs directly control the elevation of the lower portion of the lake. The flow from and water surface of Middle and Upper Lake Rohunta are controlled by outlets under road crossings. These portions of the lake have a normal elevation of about 532±.

b. Design Data

Calculation sheets used for the design of the 1943 dam modifications are available. Apparently they were used to determine the required spillway height and size for several design configurations. The design used a flood discharge rate of 184 c.s.m. or 3680 cfs with sluice gates raised.

c. Experience Data

Information obtained from State and County inspection reports indicates that the original dam at this site was

overtopped during the 1936 flood and partially breached during the 1938 flood. Calculations, made using the original plans for the dam and a flood height of 531.1', estimated the 1938 flood discharge to be approximately 2932 c.f.s.

Discharge and stage information for the current dam (a reconstruction of the original dam with some modifications), are not available. During 1964, a U. S. Geological Survey stream gaging station, No. 1-1653, was located approximately 600 feet downstream of the dam. Discharge records are available for this gage from that time until the present. A maximum discharge measurement of 496 cfs was obtained at the gage on June 29, 1972.

d. Visual Observation

Visual observations of the drainage area and general vicinity of the dam show them to be in general agreement with the U.S.G.S. maps of the area. Description of the drainage area is given in Section 1.3 of this report.

e. Overtopping Potential

This dam carries an intermediate classification for size with a low hazard potential, and as such, the spillway should be capable of passing a  $\frac{1}{2}$  PMF. This test flood was computed by determining the watershed drainage area from U.S.G.S. maps in combination with Corps discharge guide curves. A one-half PMF inflow of 6,340 cfs was developed and results, assuming sluice gates closed and stop logs in place,

in the dam being overtopped by almost three feet.

f. Dam Failure Analysis

Dam failure analysis was made assuming water to crest of dam. Using the Corps "rule of thumb" guidance, the peak failure discharge was calculated to be 13,000 cfs. This discharge was routed downstream using approximate methods. A highway bridge is located about 350 feet downstream of the dam. This bridge would probably not pass the peak failure discharge, and the structure could be overtopped. One building, not now habited, located on the right bank immediately downstream of this bridge could be inundated by 1 - 2 feet of floodwater from a potential dam failure, causing minor damage but little likelihood of loss of life. Below this point, the flood plains become much wider and there is no development near the stream.

SECTION 6  
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation

The visual observations did not disclose any immediate stability problems.

b. Design and Construction Data

The Lake Rohunta Dam is an earth embankment about 525 feet long, has a maximum crest height of about 25 feet, and contains a concrete and wood sheeting core wall. The upstream and downstream slopes are 2H:1V. The spillway is a reinforced concrete structure, with wooden sluice gates and provisions for stop logs. A 48-inch diameter penstock penetrates the dam about 30 feet to the left of the spillway. A 36-inch diameter outlet pipe is located within the spillway and a 5 foot diameter penstock is located to the right of the spillway.

The original dam was built in 1909. The dam washed out in 1938 and was repaired in 1943. The repairs included:

- (1) Construction of concrete corewall 2.5 feet higher in elevation than the original wall.
- (2) Construction of a wood sheeting cutoff wall that extended from the end of the concrete corewall to each abutment.

- (3) Construction of the left training wall of the spillway.
- (4) Crest of spillway lowered 2.0 feet.
- (5) Compacted clay was placed on the upstream and downstream faces of the corewall to within 4 feet of the crest elevation.

The design data and records of construction, however, are not sufficient to formally analyze the stability of the dam.

c. Operating Records

The available records indicate the dam was overtopped in 1936 and 1938. Major damage occurred in 1938. Since the repair of the dam in 1943, there has been no apparent problem with the dam.

d. Post-Construction Changes

Post-construction changes since the dam was built in 1909 are the extensive repairs outlined in Section 6.1.

e. Seismic Stability

The dam is located in Seismic Zone 2, and, according to USCE guidelines, it is assumed that there is no hazard from earthquake loading.

SECTION 7  
ASSESSMENT, RECOMMENDATIONS, AND REMEDIAL MEASURES

**7.1 Dam Assessment**

**a. Condition**

The visual inspection indicates the dam is in good condition.

**b. Adequacy of Information**

The information made available along with the visual inspection is adequate for a Phase I level of investigation.

**c. Urgency**

The items associated with recommendations and remedial measures should be implemented within two years after receipt of this Phase I Inspection Report by the owner.

**d. Need for Additional Investigation**

No additional investigation is needed to complete the Phase I inspection.

**7.2 Recommendations**

(1) The 4' abandoned pipe at the old laboratory location has a closed gate valve approximately 8' upstream of its exit location. This pipe is therefore possibly under a head of 11± feet, if the inlet has not been sealed. The owner should insure that the upstream inlet to the pipe is sealed to relieve any possible existing pressures.

(2) Although the dam is low hazard according to Corps guidelines, the spillway can not pass the test flood of  $\frac{1}{2}$  PMF, and the dam can overtop causing downstream damage. The owner therefore should engage a competent Consulting Engineer to evaluate further the potential for overtopping and the adequacy of the spillway.

(3) The dam should be operated at a lower level to assure adequate flood storage. The owner should engage a competent Consulting Engineer to establish this safe level of operation.

(4) The owner should establish a standard operating procedure for gradually raising the spillway gates and opening the 36 inch drawdown pipe during periods of high precipitation.

### 7.3 Remedial Measures

#### a. Operating and Maintenance Procedures

(1) Repair eroded areas on the upstream slope above the riprap.

(2) Remove all trees and brush on upstream and downstream slopes of the dam.

(3) Monitor seeps at the base of masonry section of the right training wall and seeps associated with the abandoned 4 foot pipe at the old laboratory location.

(4) The owner should insure that the sluice gate and 36 inch drawdown mechanism are in working order.

(5) This dam should be inspected every two years by qualified personnel who can identify areas of concern, which if left unchecked could jeopardize the safety of the dam.

7.4 Alternatives

Not applicable to this dam.

APPENDIX A  
INSPECTION CHECKLIST

VISUAL INSPECTION CHECKLIST  
PARTY ORGANIZATION

PROJECT Lake Rohunta

DATE Nov. 14, 1978

TIME 9:30 AM

WEATHER cloudy & cool

W.S. ELEV. 528.1+ U.S. DN.S.

PARTY:

1.	Ron H. Cheney	H H & B	6.	
2.	David Vine	H H & B	7.	
3.	Daniel P. LaGatta	GEI	8.	
4.	W. Fisher	GEI	9.	
5.	J. Wise	Rodney Hunt Corp.	10.	

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam Embankment	Daniel P. LaGatta	
2.	Spillway	Ron H. Cheney	
3.	Service Bridge	Ron H. Cheney	
4.			
5.			
6.			
7.			
8.			
9.			
10.			

## PERIODIC INSPECTION CHECKLIST

PROJECT Lake Rohunta DATE Nov. 14, 1978PROJECT FEATURE Embankment Dam NAME Ron H. CheneyDISCIPLINE Structural Engineer NAME Daniel P. LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITION
<u>DAM EMBANKMENT</u>	
Crest Elevation	532.8±
Current Pool Elevation	1" over top of sluice gates (528.1)
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	No pavement, grass cover
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	None observed
Horizontal Alignment	None observed
Condition at Abutment and at Concrete Structures	Good
Indications of Movement of Structural Items on Slopes	None
Trespassing on Slopes	None
Sloughing or Erosion of Slopes or Abutments	Minor sloughing over riprap
Rock Slope Protection - Riprap Failures	Good riprap. In some areas riprap 2 ft. below crest
Unusual Movement or Cracking at or Near Toes	
Unusual Embankment or Downstream Seepage	See text
Piping or Boils	None observed
Foundation Drainage Features	None observed
Toe Drains	None observed
Instrumentation System	None
Vegetation	Good grass cover

**PERIODIC INSPECTION CHECKLIST**

PROJECT Lake Rohunta

DATE Nov. 14, 1978

PROJECT FEATURE Spillway

NAME Ron H. Cheney

DISCIPLINE Structural Engineer

NAME Daniel P. LaGatta

Geotechnical Engineer

AREA	NOTED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>		
	<p>a. Approach Channel</p> <p>Slope Conditions</p> <p>Bottom Conditions</p> <p>Rock Slides or Falls</p> <p>Log Boom</p> <p>Debris</p> <p>Condition of Concrete Lining</p> <p>Drains or Weep Holes</p> <p>b. Intake Structure</p> <p>Condition of Concrete</p> <p>Stop Logs and Slots</p>	<p>No approach channel</p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p></p> <p>No intake structure. Outlet pipes pass through sections of spillway with gates on upstream face.</p>

**PERIODIC INSPECTION CHECKLIST**

PROJECT Lake Rohunta DATE Nov. 14, 1978

PROJECT FEATURE Spillway NAME Ron H. Cheney

DISCIPLINE Structural Engineer NAME Daniel P. LaGatta

**Geotechnical Engineer**

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - CONTROL TOWER</u>	<p>a. Concrete and Structural</p> <p>General Condition</p> <p>Condition of Joints</p> <p>Spalling</p> <p>Visible Reinforcing</p> <p>Rusting or Staining of Concrete</p> <p>Any Seepage or Efflorescence</p> <p>Joint Alignment</p> <p>Unusual Seepage or Leaks in Gate Chamber</p> <p>Cracks</p> <p>Rusting or Corrosion of Steel</p> <p>b. Mechanical and Electrical</p> <p>Air Vents</p> <p>Float Wells</p> <p>Crane Hoist</p> <p>Elevator</p> <p>Hydraulic System</p> <p>Service Gates</p> <p>Emergency Gates</p> <p>Lightning Protection System</p> <p>Emergency Power System</p> <p>Wiring and Lighting System</p>
	<p>No control tower</p> <p>All control gates and sluice are manually operated.</p>

## PERIODIC INSPECTION CHECKLIST

PROJECT Lake Rohunta DATE Nov. 14, 1978  
PROJECT FEATURE Spillway NAME Ron H. Cheney  
DISCIPLINE Structural Engineer NAME Daniel P. LaGatta  
Geotechnical Engineer

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL</u>	No outlet structure
General Condition of Concrete	
Rust or Staining	
Spalling	
Erosion or Cavitation	
Visible Reinforcing	
Any Seepage or Efflorescence	
Condition at Joints	
Drain holes	None
Channel	Good
Loose Rock or Trees Overhanging Channel	None
Condition of Discharge Channel	Good, free and open

**PERIODIC INSPECTION CHECKLIST**

PROJECT Lake Rohunta DATE Nov. 14, 1978

PROJECT FEATURE Outlet Works NAME Ron H. Cheney

DISCIPLINE Structural Engineer NAME Daniel P. LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - TRANSITION AND CONDUIT</u> General Condition of Concrete Rust or Staining on Concrete Spalling Erosion or Cavitation Cracking Alignment of Monoliths Alignment of Joints Numbering of Monoliths	No transition and conduit

**PERIODIC INSPECTION CHECKLIST**

PROJECT	Lake Rohunta	DATE	Nov. 14, 1978
PROJECT FEATURE	Spillway	NAME	Ron H. Cheney
DISCIPLINE	Structural Engineer	NAME	Daniel P. LaGatta
	Geotechnical Engineer		

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS</u>	
a. Approach Channel	No approach channel
General Condition	
Loose Rock Overhanging Channel	
Trees Overhanging Channel	
Floor of Approach Channel	
b. Weir and Training Walls	Water running over spillway at time of inspection, therefore drop wall could not be closely inspected. Some minor spalling noticed on training walls. No visible reinforcing or staining.
General Condition of Concrete	
Rust or Staining	
Spalling	
Any Visible Reinforcing	
Any Seepage or Efflorescence	
Drain Holes	
c. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Channel	Rock strewn
Other Obstructions	None

**PERIODIC INSPECTION CHECKLIST**

PROJECT Lake Rohunta DATE Nov. 14, 1978

PROJECT FEATURE Service Bridge NAME Ron H. Cheney

DISCIPLINE Structural Engineer NAME Daniel P. LaGatta

Geotechnical Engineer

AREA EVALUATED	CONDITION
<b>OUTLET WORKS - SERVICE BRIDGE</b>	Bridge over spillway
Super Structure	
Bearings	
Anchor Bolts	
Bridge Seat	
Longitudinal Members	Steel frame bridge with wood plank deck and wood hand rail spans the spillway. Hand rail is in good condition and painted. Deck is well oiled and in good condition. Steel is showing some rust but is in good condition.
Underside of Deck	
Secondary Bracing	
Deck	
Drainage System	
Railings	
Expansion Joints	
Paint	
b. Abutment & Piers	
General Condition of Concrete	
Alignment of Abutment	The spillway training walls support the service bridge and are in good condition.
Approach to Bridge	
Condition of Seat & Backwall	

APPENDIX B  
ENGINEERING DATA

LIST OF AVAILABLE ENGINEERING DATA

1. Construction Drawings dated 1908, 1939, and 1943.
2. 1942 Rodney Hunt hydraulic calculations

All of the above mentioned information is located at:

Worcester County Court House  
Engineering Department  
Worcester, Massachusetts 01009



Inspected: Mar. 25, 1936 - L.O.M. Crockett

" Jan. 27, 1937 "

" 1938 - High H<sub>2</sub>O over top catwalk

" Oct. 5 " - M.A. Casella - Athol - Oct. 26, 1938 - C.C.H. - LOM - Nov. 5 '38 - C.C.H.

" Dec. 22 " LOM. - C.C. Harris - David Sutton

" Oct. 26, " " "

" Nov. 5, " " "

" July 11, 1939 " "

" 12 " " - L.H. Sarty

Measured June 22. " LHS - JAH - M.F.H. - Field BK 10 - Pages 14-20 - also June 16, '39

Gate Plan & Pipe - Traced 3-28-40 - E.C.C. - Checked 3-29-40 - L.O.M.

Inspected: Sept. 2, 1940 - L.O.M.

" 8, 1941 - "

" June 14, 1948 - "

Survey - July 1939. " LHS - BK 10 - P. 20

" Aug. 3, " LCF - OLM - BK 10. P. 24 - Sect

" Dec. 5, 1940 LOM - LHS - JAH - OLM - BK 10 P. 24 - Levels  
1961 " .

TOWN Attn: DAM NO. 02-100

LOCATION Southwick Brook STREAM Branch Brook

*Lake Pleasant*  
WORCESTER COUNTY ENGINEERING DEPARTMENT  
WORCESTER, MASSACHUSETTS

### D A M I N S P E C T I O N R E P O R T

Owned by Edwin Hunt Machine Co. Place Range Use Storage Pond

Inspected by me Date Nov 22 1954

Type of Dam Earth embankment Condition Good

#### SPILLWAY

Flashboards in Place 5' of wood Recent Repairs None

Condition Good condition

Repairs Needed None as damage has been repaired

#### VALVE

Recent Repairs Old faucet replaced with a new one

Condition Very small leak around the faucet

Repairs Needed The valve is good

#### GATES

Recent Repairs The gate is closed - the gate stick to the door

Condition Not used. These are manual type gates

Repairs Needed Paint not in left

#### PIPE

Condition Some of the outer coverage is visible to be repaired

CONCERN

TOWN Albion DAM NO. 00-000

LOCATION Myers Rd. 200 STREAM Branch Brook

*Lake Eckhardt*

WORCESTER COUNTY ENGINEERING DEPARTMENT  
WORCESTER, MASSACHUSETTS

### DAM INSPECTION REPORT

Owned by Polymer Plant Machine Co Place Orange Use Storage Pond

Inspected by ETP-WOL Date Apr. 10 1965

Type of Dam Earth - Concrete Condition Good

#### SPILLWAY

Flashboards in Place Yes Recent Repairs Rebuilt in 1943

Condition Good

Repairs Needed None

VALVE

Condition Good

Repairs Needed None

#### VALVES

Recent Repairs None

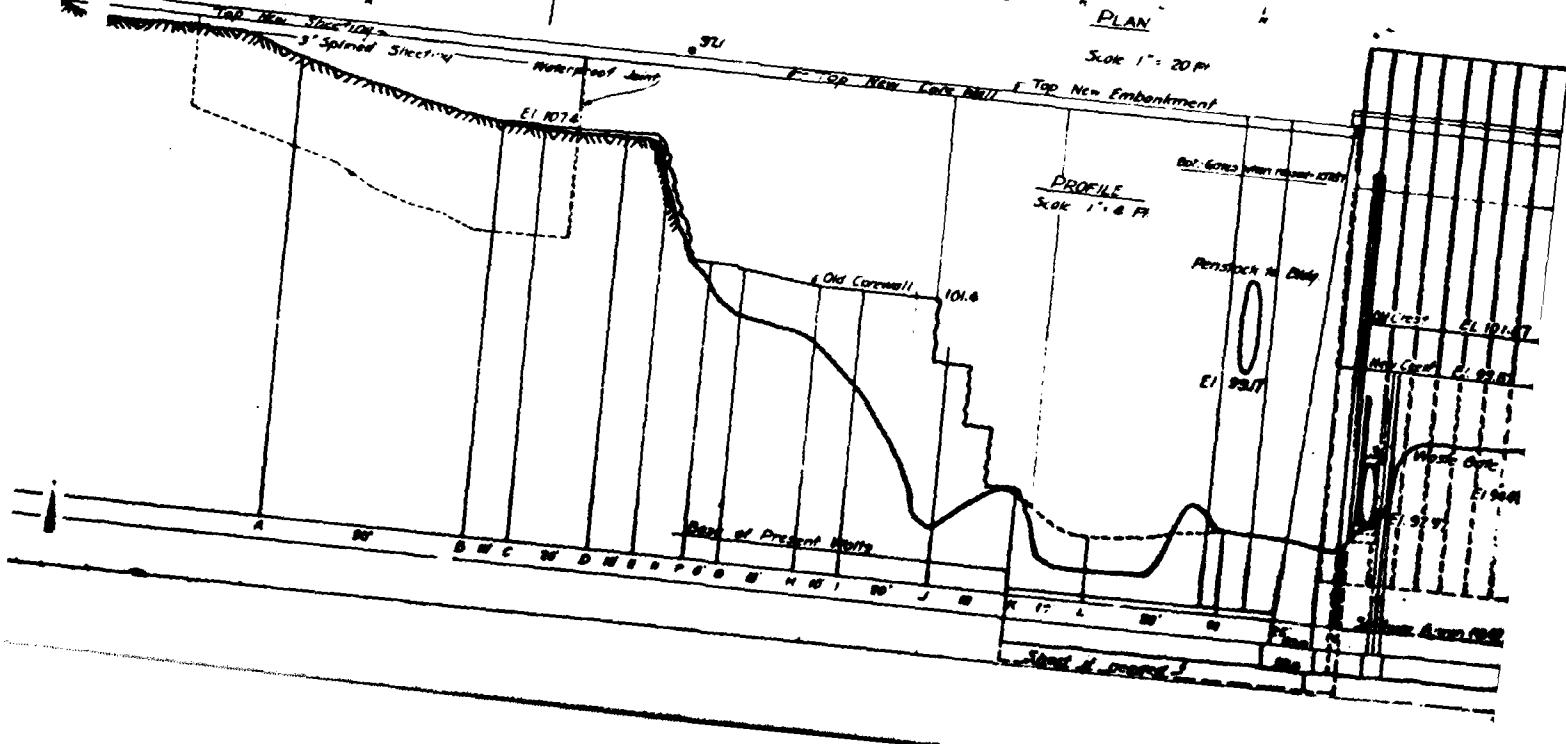
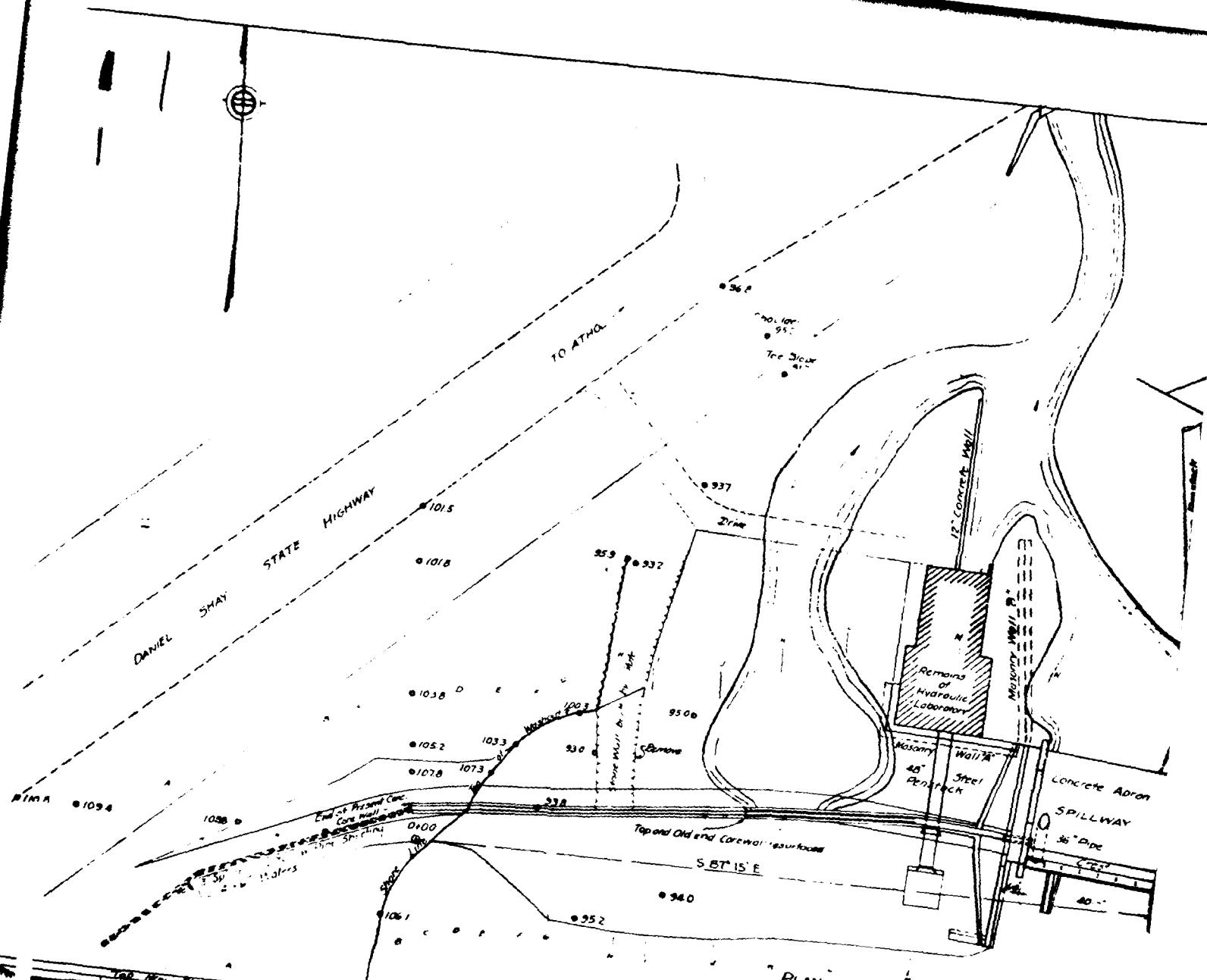
Condition Good

Repairs Needed None

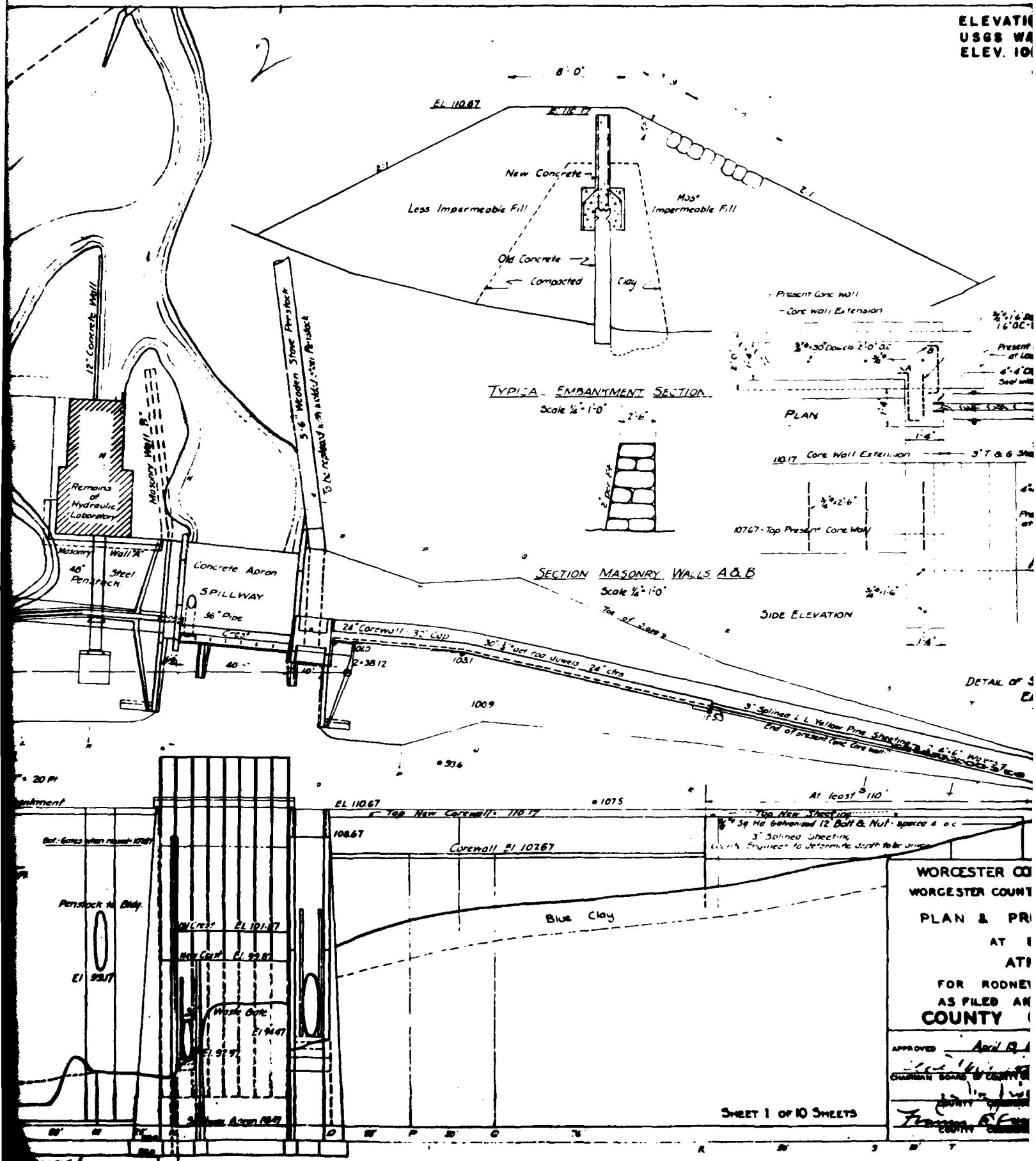
*None*

*None* Stable with

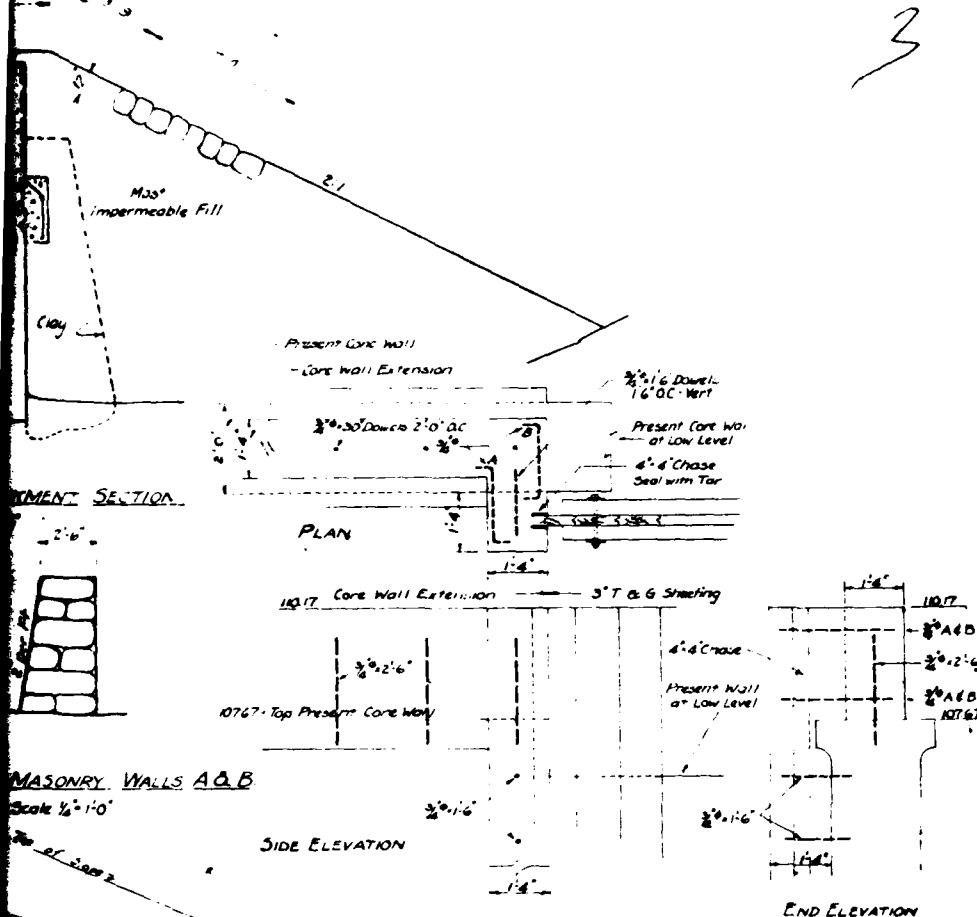
*60*



ELEVATION  
USGS WA  
ELEV. 101

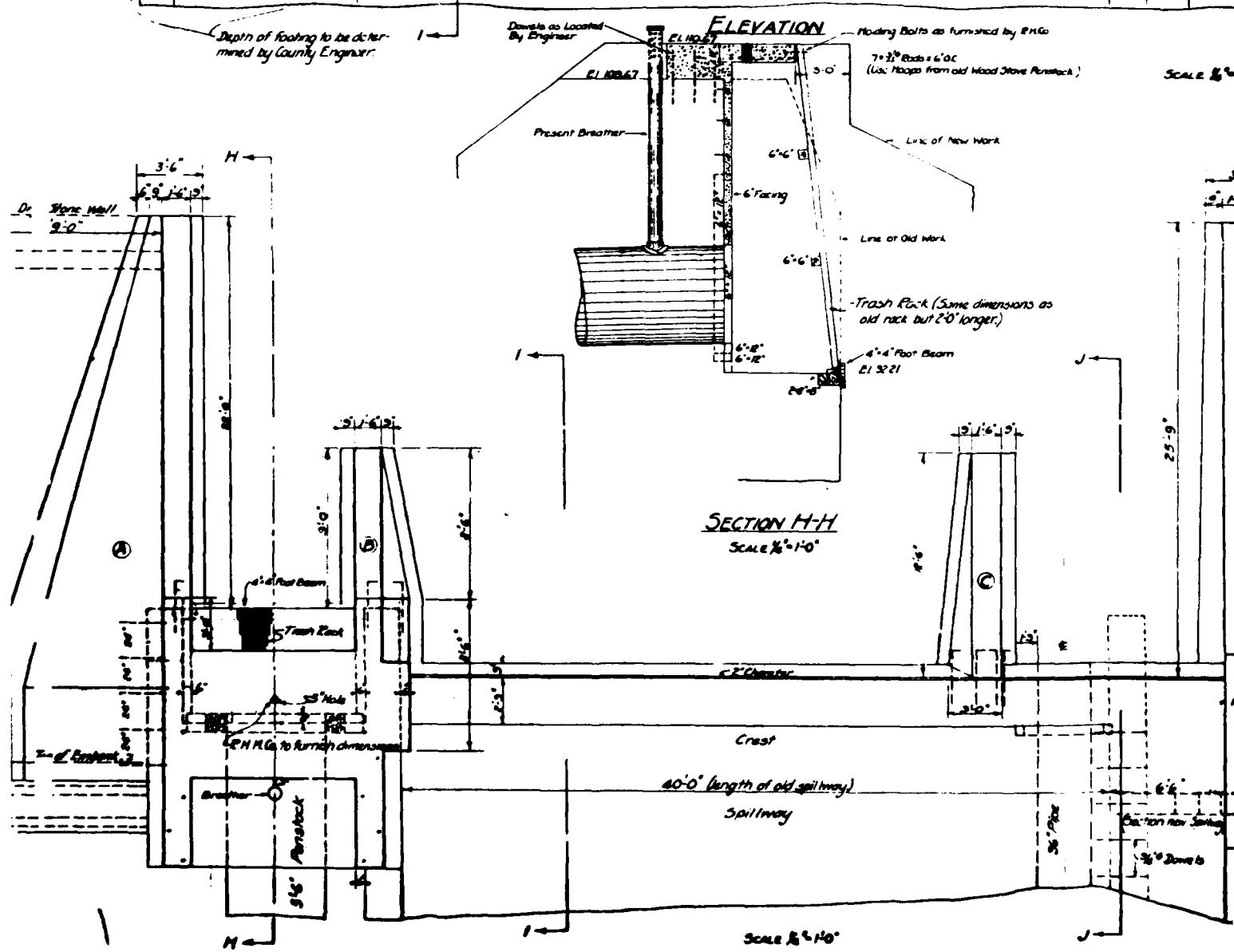
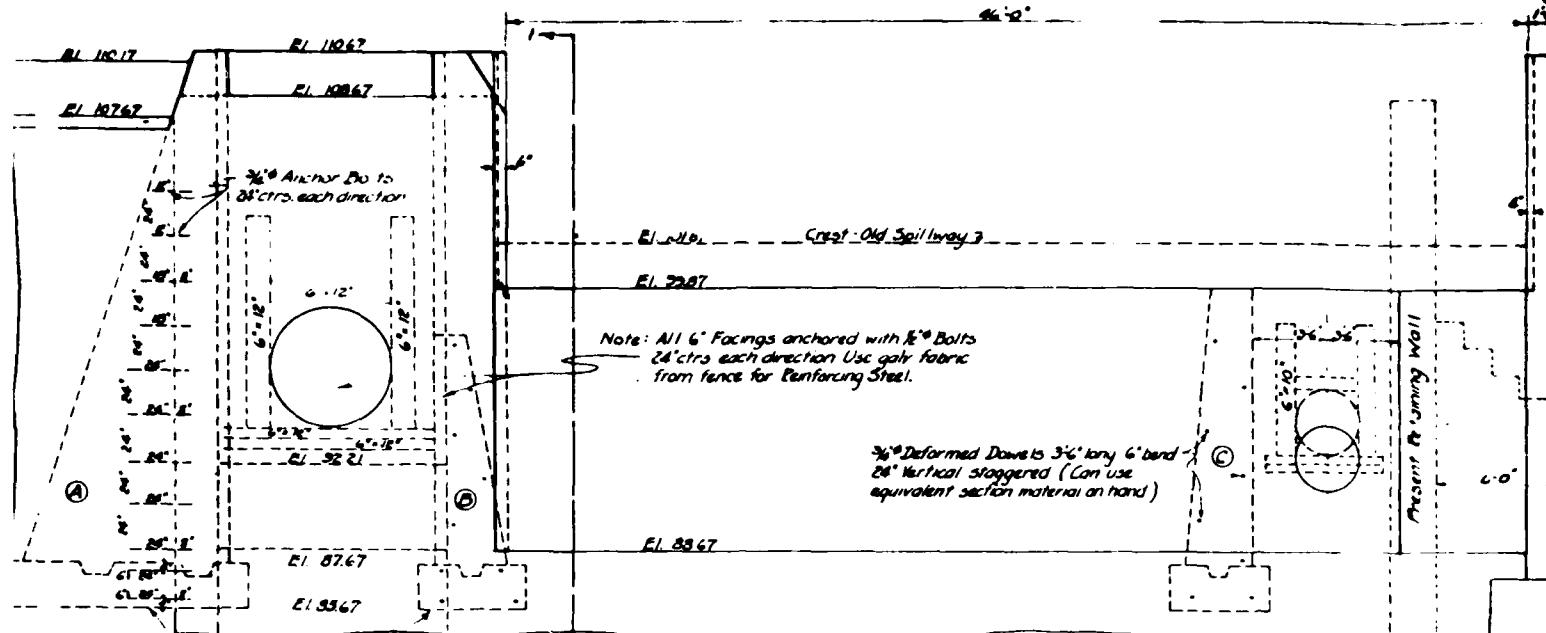


ELEVATION CONVERSION:  
USGS WATER ELEV. 530' =  
ELEV. 108' IN SUMMER



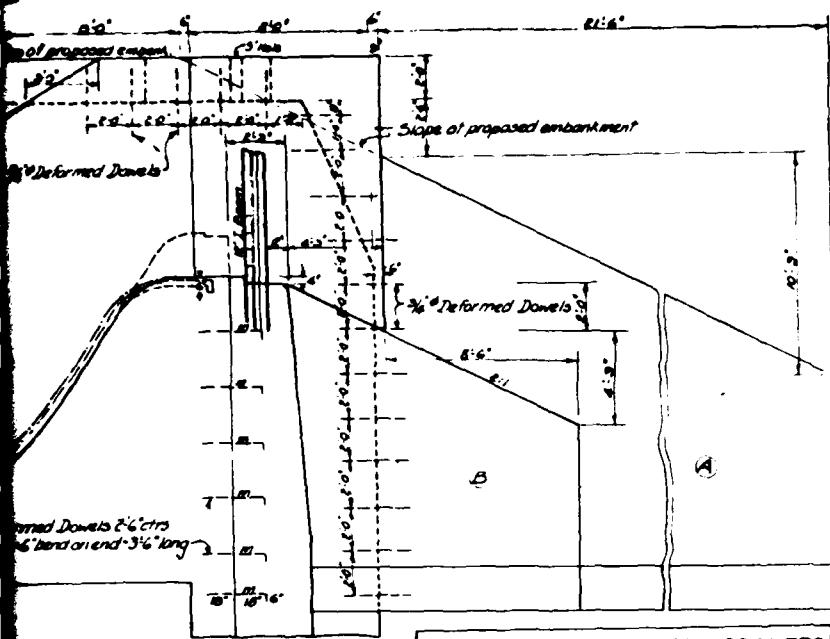
WORCESTER COUNTY COMMISSIONERS  
WORCESTER COUNTY ENGINEERING DEPARTMENT  
PLAN & PROFILE OF SITE AT DAM  
AT LAKE ROHUNTA  
ATHOL, MASS.  
FOR RODNEY HUNT MACHINE CO.  
AS FILED AND APPROVED BY THE  
COUNTY COMMISSIONERS

APPROVED	April 13, 1948	SUBMITTED FOR APPROVAL Apr 13 1948
<i>John W. Martin</i> Chairman Board of County Commissioners		<i>P. O. Martin</i> COUNTY ENGINEER
COUNTY COMMISSIONERS		RODNEY HUNT MACHINE CO.
<i>Franklin S. Nichols</i> County Commissioner		DAM NO. 02-24



## PLAN OF FOREBAY, WASTEWAY AND WALLS

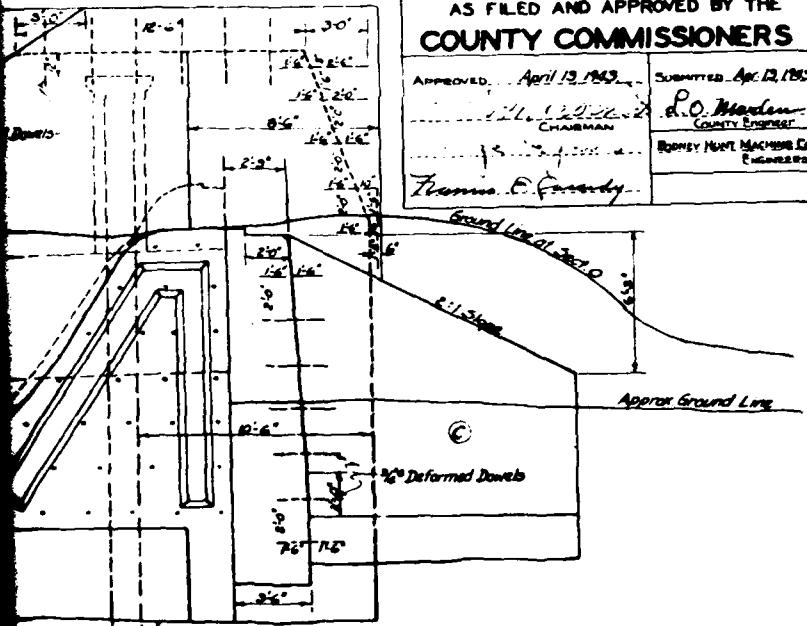




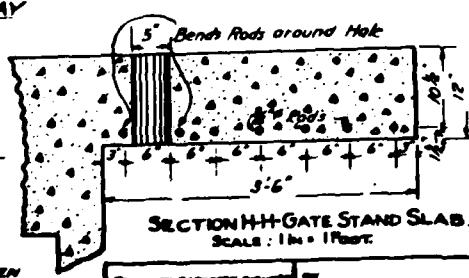
SECTION 1-1 WASTEWAY  
SCALE 1/8" = 1'-0"

WORCESTER COUNTY COMMISSIONERS  
WORCESTER COUNTY ENGINEERING DEPT.  
FOREBAY-WASTEWAY & WALLS  
AT LAKE ROHUNTA  
ATHOL, MASS.  
FOR RODNEY HUNT MACHINE CO.  
AS FILED AND APPROVED BY THE  
**COUNTY COMMISSIONERS**

APPROVED: April 12, 1952	SUBMITTED: April 12, 1952
P. O. Maden Chairman	
RODNEY HUNT MACHINE CO. ENGINEERS	
Thomas E. Faraday	



SECTION 1-1 WASTEWAY  
SCALE 1/8" = 1'-0"



SECTION H-H GATE STAND SLAB.  
SCALE: 1/8" = 1'0"

DETAIL OF KEY BETWEEN  
PANEL AND WALL

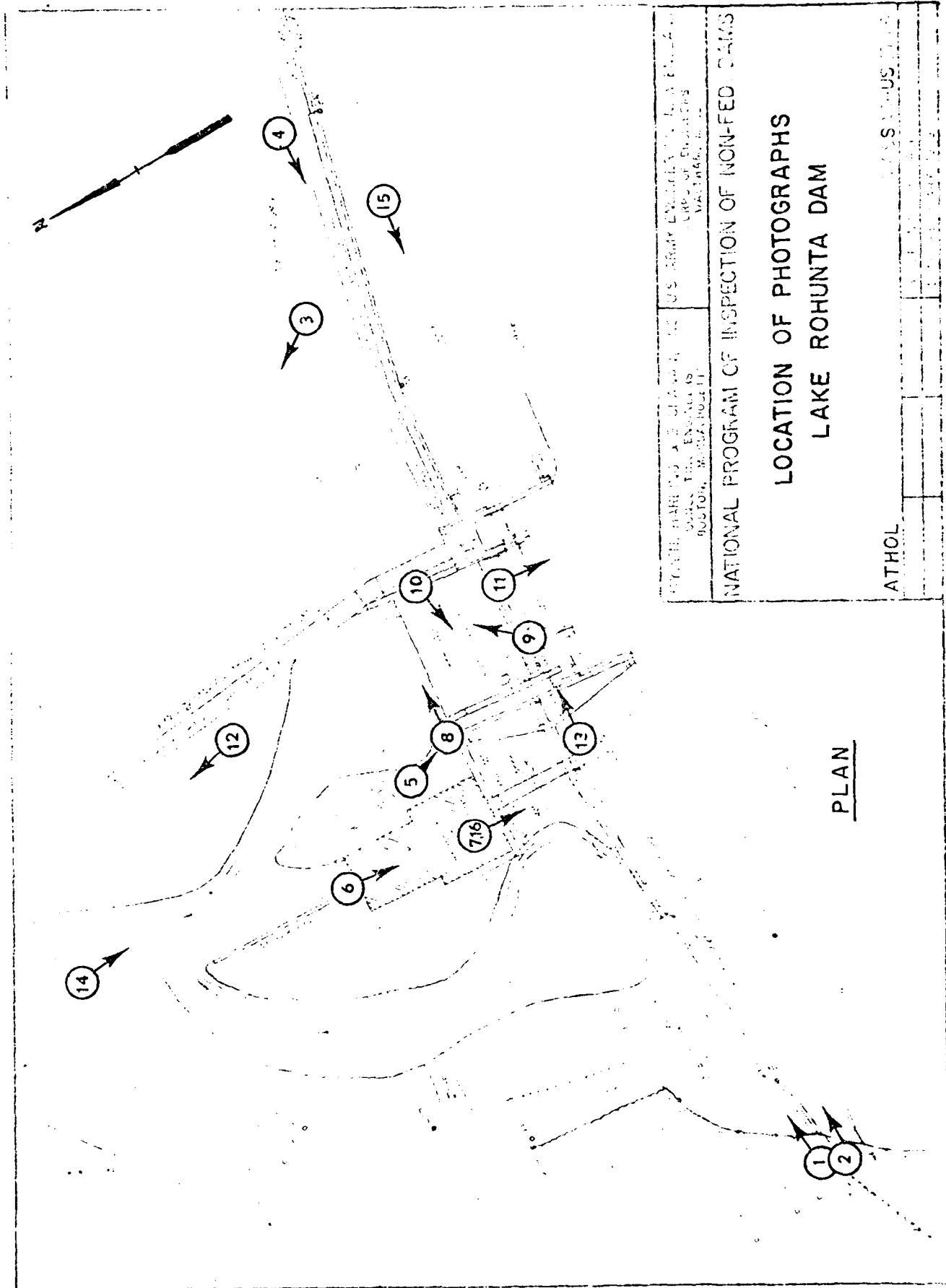
SCALE: 1/4" = 1'0"

(NOT Scale Print)

3

WORCESTER COUNTY FORMED BY	OWNER BY
S. O. Maden	S. O. Maden
APPROVED BY	
SHEET 2 OF 10 SHEETS DAY NO. 102-40	

APPENDIX C  
PHOTOGRAPHS



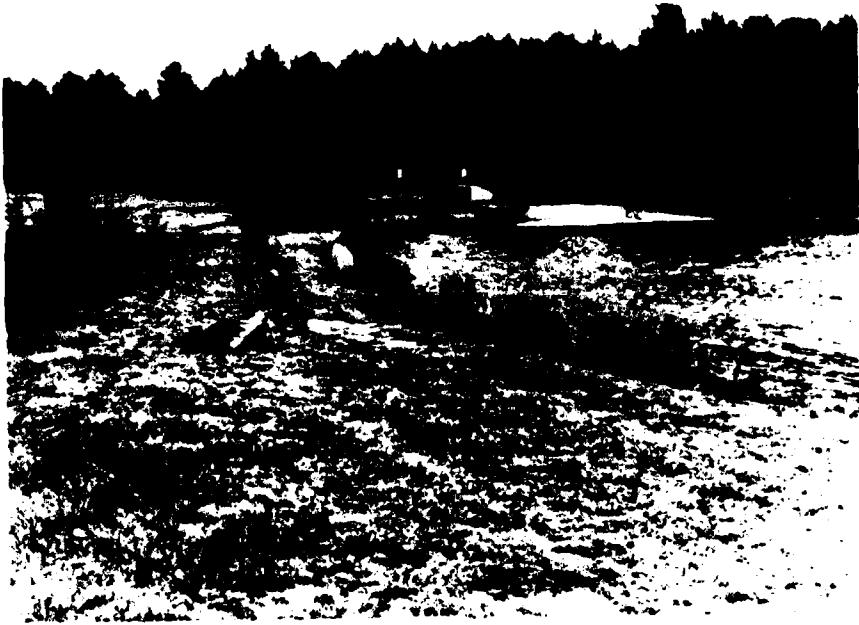


PHOTO NO. 1 - Crest of dam viewed from left abutment.



PHOTO NO. 2 - Close-up view of exposed concrete core wall near left abutment.

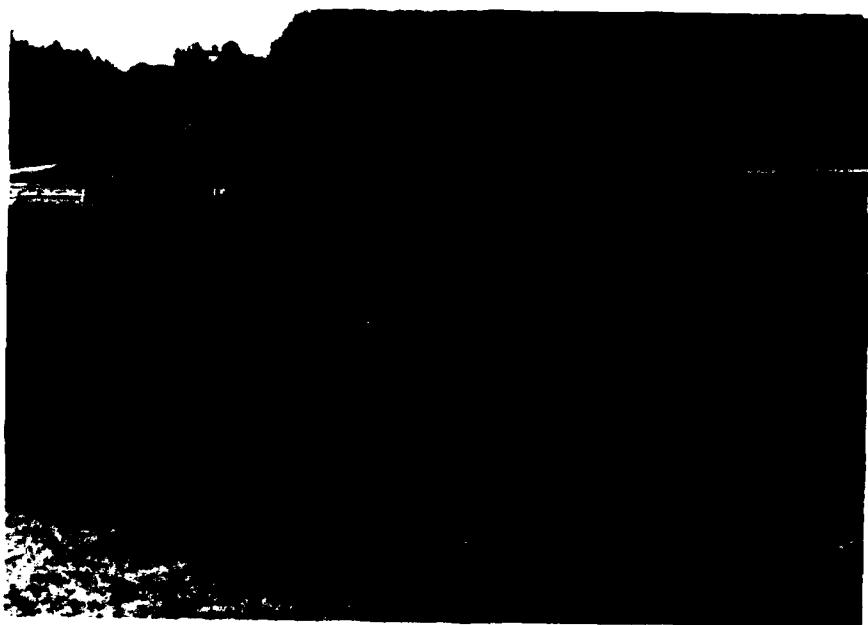


PHOTO NO. 3 - Overgrown and moist area at toe of dam adjacent to the right training wall of spillway. Note concrete box at right edge of photo.



PHOTO NO. 4 - Crest of dam viewed from right abutment.



PHOTO NO. 5 - Masonry wall at downstream toe of dam adjacent to the left training wall of spillway. Note trees and ruler is extended five feet.



PHOTO NO. 6 - Concrete wall of old hydraulic laboratory and abandoned outlet pipe. Note ruler is extended five feet.



PHOTO NO. 7 - Close-up view of seepage from the abandoned outlet pipe. Ruler is extended one foot.



PHOTO NO. 8 - Right training wall of spillway. Note seepage from masonry section as evidenced by rust color staining. Seepage at base of concrete section shown as tan streaks.



PHOTO NO. 9 - Overgrown and moist area at toe of dam adjacent to right training wall of the spillway. Note that the concrete box is at center of photo at edge of overgrown area.



PHOTO NO. 10 - Left training wall of spillway and downstream slope of dam to the left of spillway.



PHOTO NO. 11 - General view of Lake Rohunta



PHOTO NO. 12 - View of Downstream roadway bridge



PHOTO NO. 13 - View of steel frame, wood planked service bridge taken from left abutment



PHOTO NO. 14 - Downstream face of spillway and left embankment



PHOTO NO. 15 - Upstream face of dam viewed from right abutment. Note riprap in good condition. Ruler in center of photo is extended three feet.



PHOTO NO. 16 - Close-up view of seepage from base of concrete wall beneath the abandoned outlet pipe. Ruler is extended one foot.

APPENDIX D  
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

715.004.1  
2/12/73  
112  
FD 112179

**HH  
&B**

**HAYDEN, HARDING & BUCHANAN, INC.**  
CONSULTING ENGINEERS  
BOSTON MASSACHUSETTS

**SHEET NO. 107**

**JOB 112179**  
**SUBJECT 112179**  
**CLIENT C.H.B.**

Built 1940 to 1945 - replacement  
Structural Height 20'.

Hyd. " 17' 6200/s.m.

Max. Elevation 1750 ft. 1 cfs = 91.82 cfs

Nom. " 1300 "

Conc. Class = II - Intermediate: Haz. L = low

Protrusion Area 20.3 sq. mi. (U.S. D. I. - G.S. Sta 1653  
built 1964 - Max Flow 420 cfs April '67).

Max flood 1956 Flow 531.1, 005' above "OLD  
DAM"

in drainage path 537' to 1200' or 66E. a elev.  
stream flow for 28,000'  
Lake / pond flow for 22,000' .

Conc. as flat or coastal" M.F. = 625  
or 12,688 cfs  $\frac{\text{cfs}}{\text{sq mi}}$

Bed of pond elev 92.97 ( datum unknown )

Top of railway " 99.87 (crest)

Top of gates " 105.87

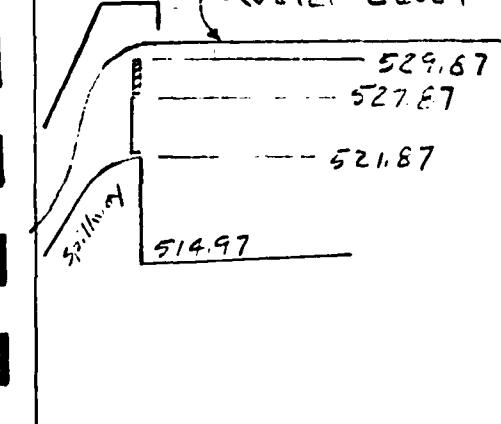
Top of flashboards " 107.87 - typ in summer

Top of dam " 110.67

USGS water " 550.  $\approx$  106.00 in summer

Correction  $\approx$  422'

532.67' - Water Level 530'

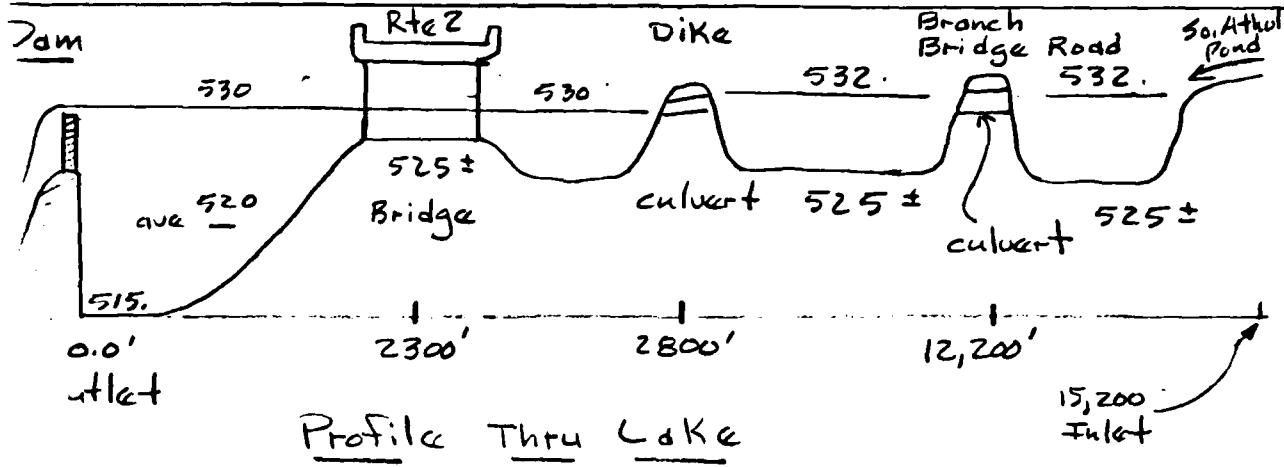


78244-1  
12/13/78  
m4  
FDD

HH  
& B

HAYDEN, HARDING & BUCHANAN, INC.  
CONSULTING ENGINEERS  
BOSTON, MASSACHUSETTS

SHEET NO. 2 of  
JOB Dam  
SUBJECT Rohunts  
CLIENT Corp



### Surface Areas

	<u>Sq in</u>	
Ele. 525	$0.42 + 2.92 = 3.34$	
Ele. 530	0.42	540 Lower = 1.12 <u>Sq in.</u>
Ele. 532	2.92	532 " 0.56 "
" 540	7.20	
537	$(-)(7.2 - 3.34) \frac{3}{8} + 7.20 = 5.75$	

From Records 1938 flood overtopped old  
dam by 0.5' to elev. 531.1' or 109.1  
assume flash boards were used - Calcs  
by R. Hunt Co.

spillway  $Q = 3.33 \times 31.68 \times 6.45^{\frac{3}{2}} = 1930 \text{ cfs}$

Dam  $Q = 3.33 \times 5.68 \times 5.28^{\frac{1}{2}} = 213 \text{ "}$

"  $Q = 3.3 \times 60 \times 0.77^{\frac{3}{2}} = 122 \text{ "}$

"  $Q = 3 \times 330 \times 0.77^{\frac{3}{2}} = 470 \text{ "}$

+

2750

+ 182

2932 cfs

36" pipe

$$\frac{2865}{20.3} = 141 \text{ cfs / sm}$$

78-244 1  
12.13.78  
MA  
FDD

HH  
& B

HAYDEN, HARDING & BUCHANAN, INC.  
CONSULTING ENGINEERS  
BOSTON, MASSACHUSETTS

SHEET NO. 3 of  
JOB Date  
SUBJECT Hyd. Unit  
CLIENT Corps

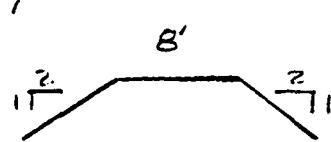
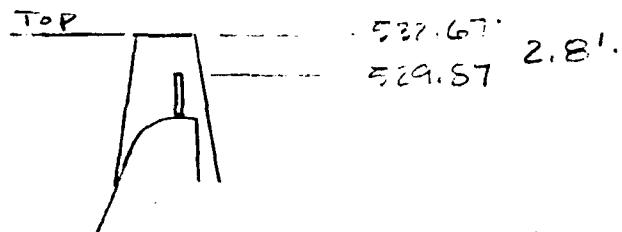
Size Class = Intermediate  
Hazard Potential = Low  
Test Flood = 1/2 PMF

$$1/2 \text{ PMF} = 6,344 \text{ cfs}$$

Assume all pipes are closed-off and gates are in down position with 2' of flash boards - typical summer/winter operation.

(5.3 K-8)

Spillway  $Q = 3.02 (46.5)(2.8)^{3/2} \approx 723 \text{ cfs}$   
water will flow over spillway



$$\text{Length} = 580'$$

$$Q_{\text{Top of Dam}} = 3.02 (580)(5.5)^{3/2} = 2259 \text{ cfs}$$

$$Q_D = 2.65 (580)(3.0)^{3/2} = 79.86 \text{ cfs}$$

Depth	$Q_D + C_S$	$Q_{\text{road}}$	1	$Q_D$
5.5'	23316	>	$\frac{540}{1447}$	$2.64 (580)(2.0)^{3/2} = 4330$
3.0'	8710	>	"	$2.65 (580)(2.5)^{3/2} = 6075$
2.0	5053	<	"	$2.65 (580)(2.8)^{3/2} = 5187$
2.5	6800	>	"	$2.65 (")(2.37)^{3/2} = 5107$
2.25	5910	<	2.37' over C = 6330	

if gate post 5' unit were blocked w/ debris what would depth be.

$$Q_D = 2.65 (580)(H)^{3/2} = 6344$$

$$H^{3/2} = 4.43$$

$$H \approx 2.7 \text{ ft.}$$

$$Elev. = 535.37 \text{ say}$$

78.244.1  
12/14/78  
m4  
FD

**HH**  
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SHEET NO. 4 of  
JOB Dam  
SUBJECT Kobinata  
CLIENT Corps

600 a/sym

Storage Capacity - (Variable since actual depth  
unknown)

Both Ponds

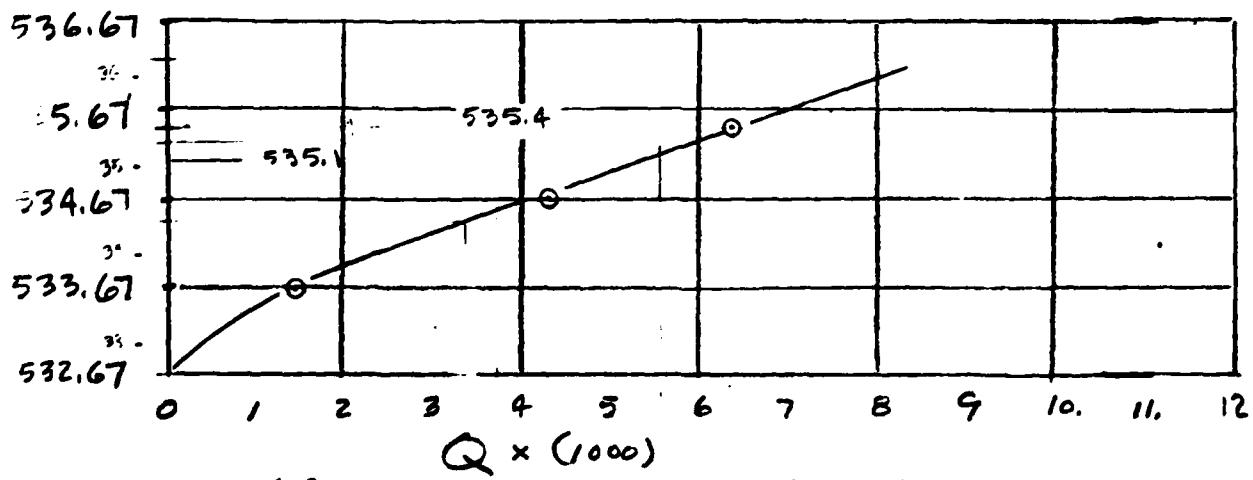
	<u>EL&amp;V</u>	<u>Area Sym</u>	<u>Acres</u>	<u>Ave Acre</u>	<u>Stor</u>	<u>Accum Stor</u>
Bottom	525	3.34	307.	—	—	0
Flash	529.67	—	—	—	—	—
Water	530.00	—	(315)	(311)	(1555)	—
	532.00	3.48	320	314	2195	2195
Top	532.67	3.79	350	335	225	2420
PMF	535.40	—	465	408	113	3533
	540.00	7.20	661			

$$Q_{P1} = 6344 \text{ cfs}$$

$$EL_1 = 535.4$$

$$Stor_1 = 1113 \text{ acf} \times 12''/F \times \frac{1}{20.3 \times 640} = 1.03'' \text{ Runoff}$$

$$Q_{P2} = 6344 \times \left(1 - \frac{1.03}{9.5}\right) = 5656 \text{ cfs}$$



(for spillway blocked with debris)

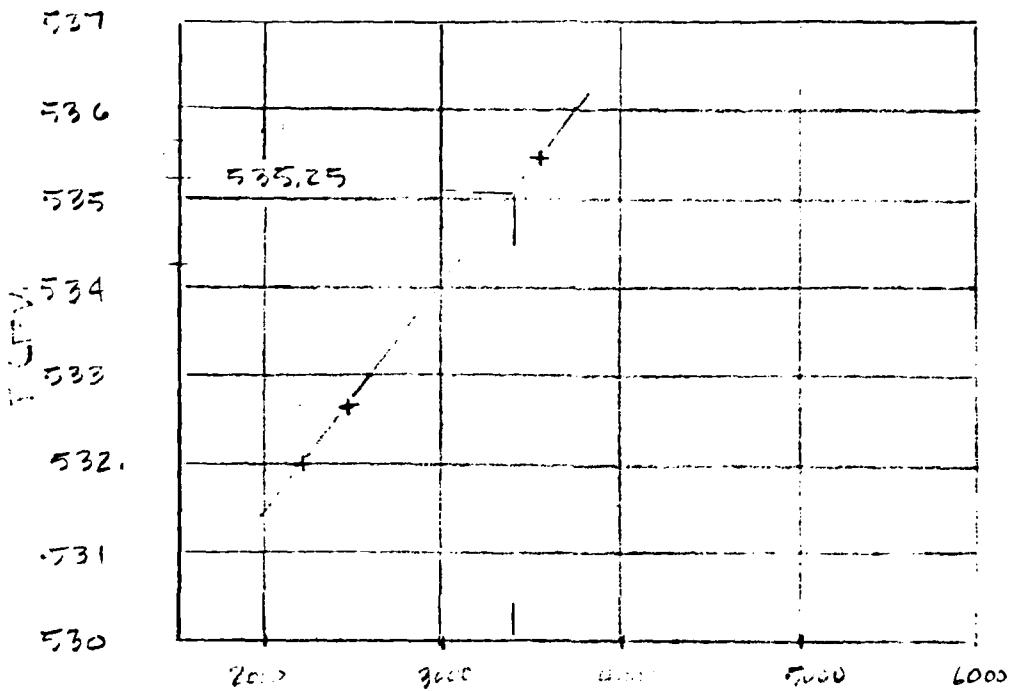
8 NO. 78.244.1  
DATE 10/14/74  
BY WIA  
ED BY FDD

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& B

HAYDEN, HARDING & BUCHANAN, INC.  
CONSULTING ENGINEERS  
BOSTON, MASSACHUSETTS

SHEET NO. 5 of

JOB Linen's  
SUBJECT K-1  
CLIENT Corps



Stor. (includes base storage)

$$FL_{cu2} = 535.1$$

$$Stor_2 = 3375 - 2920 = 955 \text{ af}$$

$$Avg Stor = \frac{1}{2}(1113 + 955) = 1034 \text{ af}$$

$$Q_{F3} = 6000 \text{ cfs. Test Flood Outflow}$$

78.249.1

2/14/78

FDD

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& B

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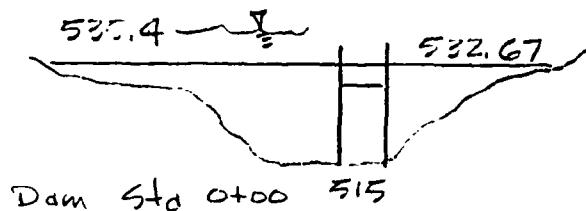
SHEET NO. 6 of

JOB Davis

SUBJECT Kohuric

CLIENT Corp

### Failure Analysis



$$Q_{P_1} = \frac{8}{27} w_b \sqrt{g} \gamma_0^{3/2}$$

$$w_b = 0.4 (z_1 \delta) = 84'.$$

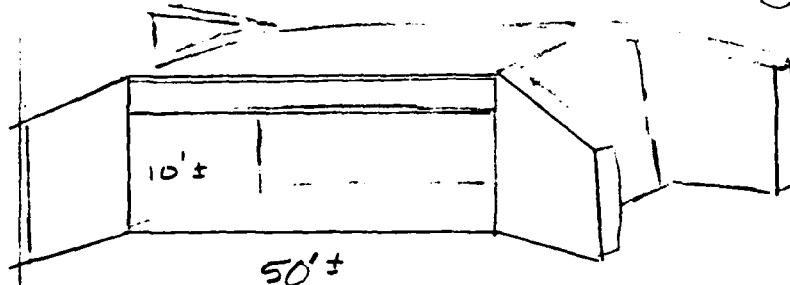
$$\gamma_0 = 535.4 - 515 = 20.4$$

$$Q_{P_1} = \frac{8}{27} (84) \sqrt{22.2} (20.4)^{3/2}$$

$$Q_{P_1} = 13,000 \text{ cfs}$$

From USGS May 8 Inspections, no 1's are  
w/in flood plain dist. of dam.

Sta 250' At. highway bridge



$$2L + 2S = 12 \times 2 + 2 \times 6 + 4 \\ 24' + 16' + 4 = 44' \text{ wide}$$

$$Q_{\text{need}} = 13000 \text{ cfs}$$

$5 \approx 0.5\%$  assume cut/cr submerged

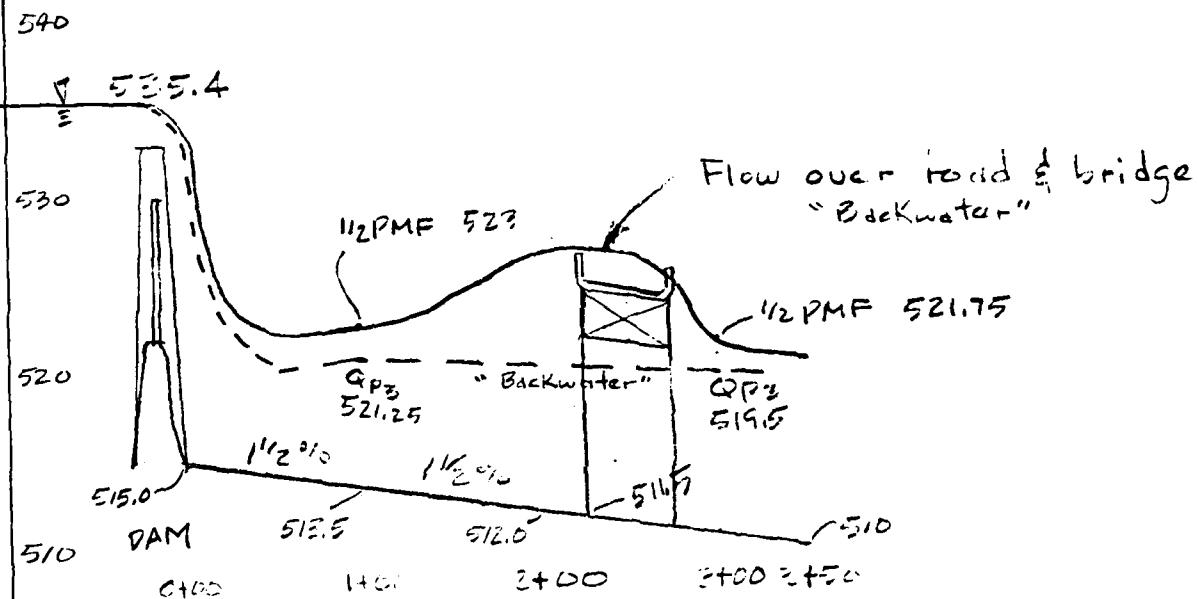
D	A	W <sub>P</sub>	R	R <sup>2/3</sup>	$\frac{1.486}{1015} (0.05)^{1/2}$	V	Q
4'	200. SF	58'	3.45.	2.29	6.94	19.98	3176 cfs
6'	300.	62'	4.84	2.88	"	19.99	5996
8'	400.	66'	6.06	3.34	"	23.18	9272
9.75'	487.5	69.5.	7.01	3.69	"	25.61	12484

78.26.1  
11/17  
1:5  
FDD

HH  
&B

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• SHEET NO. 7 of  
JOB Dams  
SUBJECT 1  
CLIENT City



$\Sigma h = 14.00$

$$A = 4(62.5) + 100 = 350 \text{ ft}^2$$

$W_p = 70'$

$$R = \frac{1}{2} \cdot 25.4$$

$$Q = VA$$

$$V = \frac{1.486}{0.05} (2.94) (0.015)^{1/2} = 10.70 \text{ ft/s}$$

$$Q = 3747 \text{ cfs NG}$$

$D = 6.5'$  w/m channel only

$\Sigma = 11.5'$  onto "flat plain"

$$V = \frac{1.486}{0.05} \left( \frac{950}{70} \right)^{1/2} (0.1225) ; \frac{1.486}{0.05} \left( \frac{550}{100} \right)^{1/2} (0.1225)$$

$$= 20.9 ; 13.$$

$$Q = 20.9 \cdot (950) + 13 \cdot (550) = 19850 + 7150 = 27000 \text{ cfs} \gg 13000 \text{ cfs}$$

$D = 10.0'$

$$V = \frac{1.486}{0.05} \left( \frac{860}{70} \right)^{1/2} (0.1225) ; \frac{1.486}{0.05} \left( \frac{550}{100} \right)^{1/2} (0.1225) = 19.55 ; 12.5$$

$$Q = 19.55 \cdot (860) + 12.5 \cdot (550) = 16821 + 4625 = 21446 \text{ cfs}$$

78.244.1  
11/17/78  
1.1  
FDD

HH  
&B

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CONSULTING ENGINEERS  
BOSTON, MASSACHUSETTS

SHEET NO. 8  
JOB D-1000-5  
SUBJECT F-1111-7.1  
CLIENT C-1-15

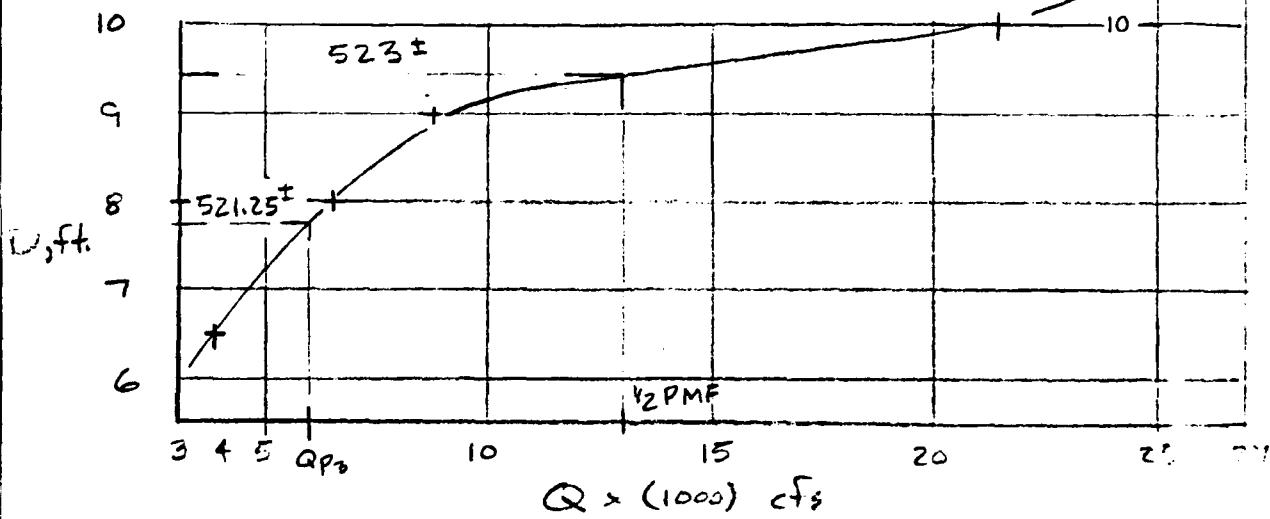
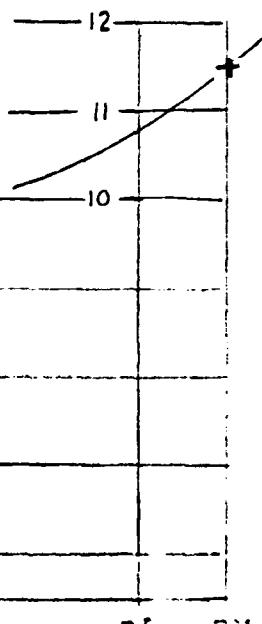
$V = 8'$

$$A = 350 + 90 = 440 \text{ sf} \quad w_p = 70' \quad k = 6.29' \\ A_{FP} = 8(1.5)(1.6) = 120 \text{ sf} \quad w_{p,0} = 65' \quad R = 1.85'$$

$$V_R = \frac{1486}{.05} (3.42)(.1225) = 12.45'$$

$$V_{P,0} = \frac{1.486}{.035} (1.511)(.1225) = 7.8'$$

$$Q = 54.79 + 9.34 = 6412.5 \text{ cfs}$$



$D = 9'$

$$A = 500 \text{ sf} \quad w_p = 70 \quad R = 7.14 (3.73) \\ A = 210 \text{ sf} \quad w_p = 85 \quad R = 2.47 (1.83)$$

$$\frac{V}{13.6} \cdot \frac{Q}{6790} \\ \frac{9.5}{9.5} \cdot \frac{2000}{8190}$$

o. 72,249.1  
11-17-12  
67-1  
BY FDD

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BOSTON, MASSACHUSETTS

SHEET NO 98  
JOB Dams  
SUBJECT Robert T. S.  
CLIENT Corps

Storage between 0+00 to 1+00

$$A_{R,00} \quad 0+00 = 100(10) + \frac{1}{2}(50)(10) + \frac{1}{2}(50)(10) = 1500 \text{ sf}$$

$$" \quad 1+00 \approx 1500 \text{ sf}$$

$$Vol = 1500 (100) = 150000 \text{ cu ft} \quad \text{or} \quad 0.344 \text{ cfs} < 125.$$

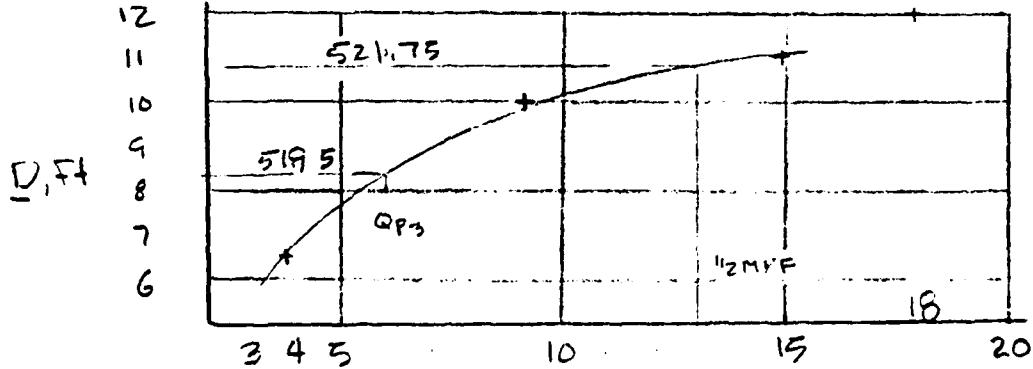
std 3+00  $Q_R = Q_R @ \text{std } 1+00$ .

D = 6.5'  $Q = 2747 \text{ cfs}$

D = 10'  $A_R = 350 + 6(35) = 560 \quad \frac{WP}{70} \quad \frac{R}{8(4.03)} \quad \frac{V}{19.7} \quad \frac{Q}{8216}$   
 $A_B = 150 \text{ sf} \quad \frac{70}{70} \quad 2.14(1.67) \quad 6.07 \quad \frac{910}{9126}$

D = 12'  $A_R = 780 \quad 70 \quad 11.14(5.03) \quad 183 \quad 14281$   
 $A_B = 310 \quad 90 \quad 3.44(2.29) \quad 11.91 \quad \frac{3692}{17973}$

D = 11  $720 \quad 70 \quad 10.28(4.74) \quad 17.4 \quad 12494$   
 $230 \quad 80 \quad 2.88(2.03) \quad 10.55 \quad \frac{2927}{14921}$



$$Q \times (1000) \text{ cfs}$$

Storage between 1+00 to 3+00

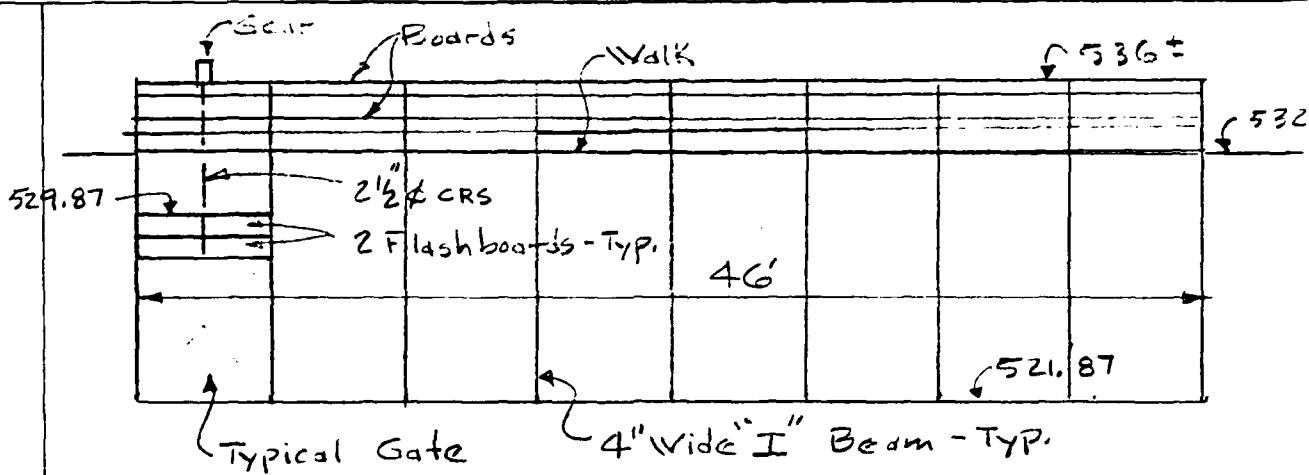
$$Area = (1500 + 950) \frac{1}{2} = 1225.$$

$$Vol = 1225 \times 200 \times \frac{1}{43560} = 5.6 \text{ cfs OK}$$

10. 78.240.1  
12/15/78  
by H  
FDD

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SHEET NO. 10 of  
JOB Dams  
SUBJECT Pichunta  
CLIENT Corps



Spillway - gates down w/ 2' Flashboards - Typical C.

$$\text{Width} = 46' - \left( 8 \times \frac{2.5}{12} + 7 \times \frac{4}{12} \right) = 46 - 4 = 42'$$

$$\text{Height} = 532.67 - 529.87 = 2.8'$$

$$Q = C C L H^{3/2}$$

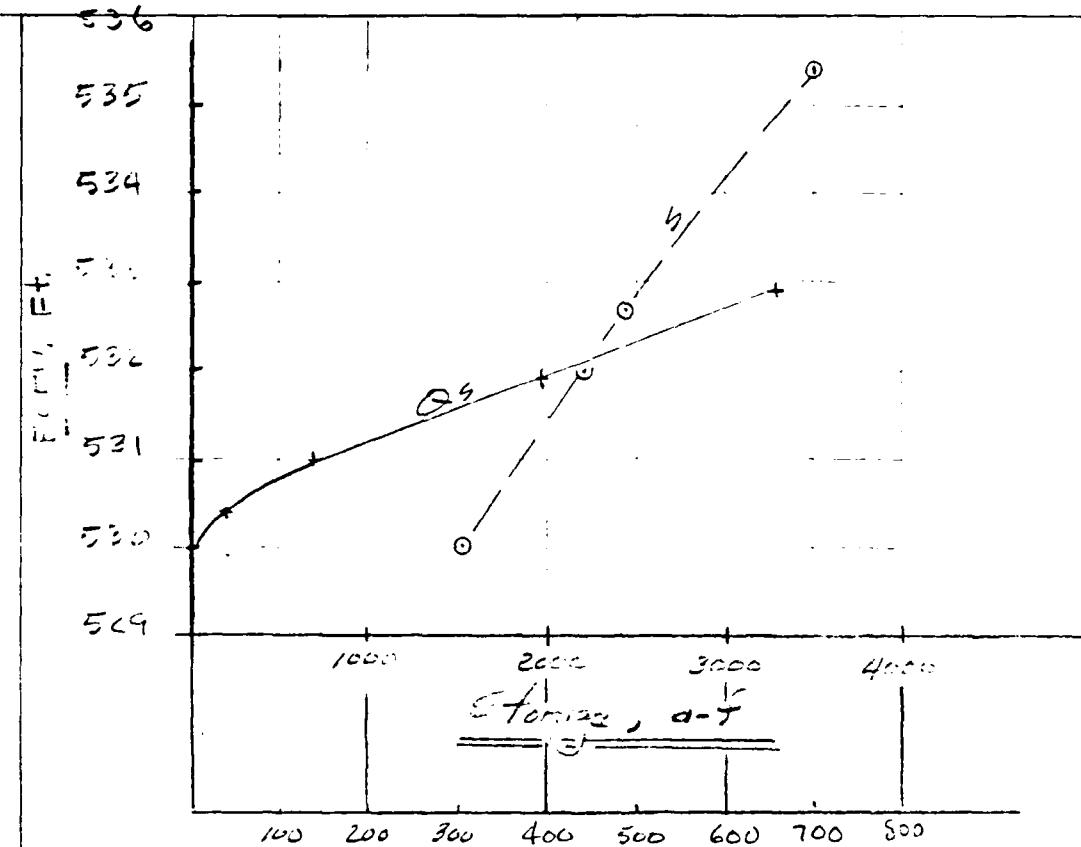
<u>ELEV</u>	<u>H</u>	<u>C</u>	<u>CxL</u>	<u>H<sup>3/2</sup></u>	<u>Q cfs</u>
529.87	0	0	0	0	0
530.37	0.5	3.0	126	0.35 <sup>1.67</sup>	44.55 <sup>2.33</sup>
530.87	1.0	3.32	139.44	1.00	139.44
531.87	2.0	3.32	"	2.83	314.4
532.67	2.8	3.32	"	4.69	653.3

171472  
MA  
FDD

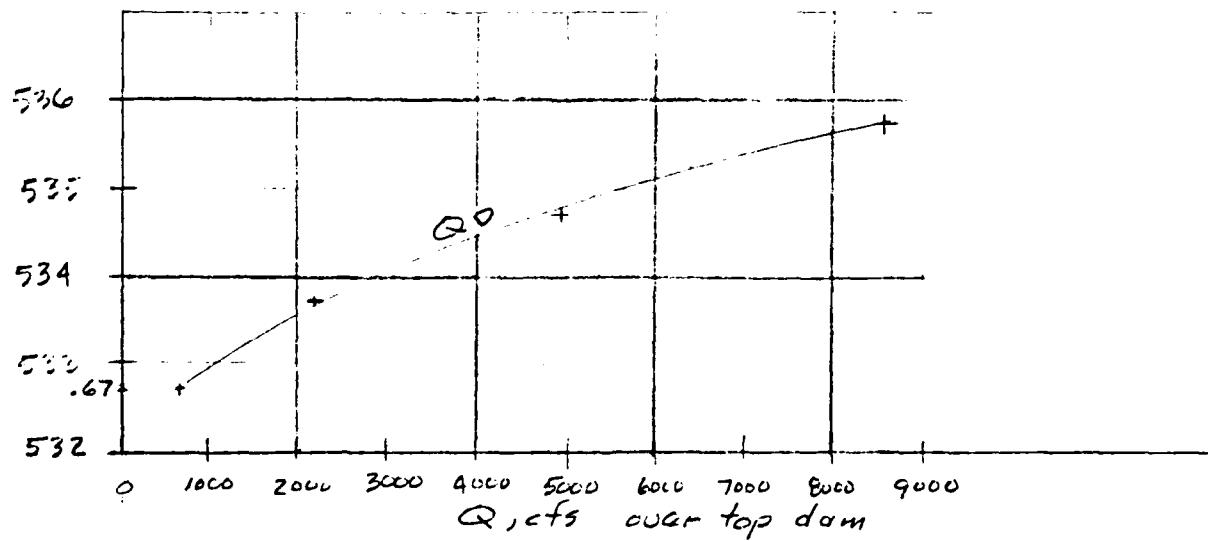
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BOSTON MASSACHUSETTS

SHEET NO 11 of

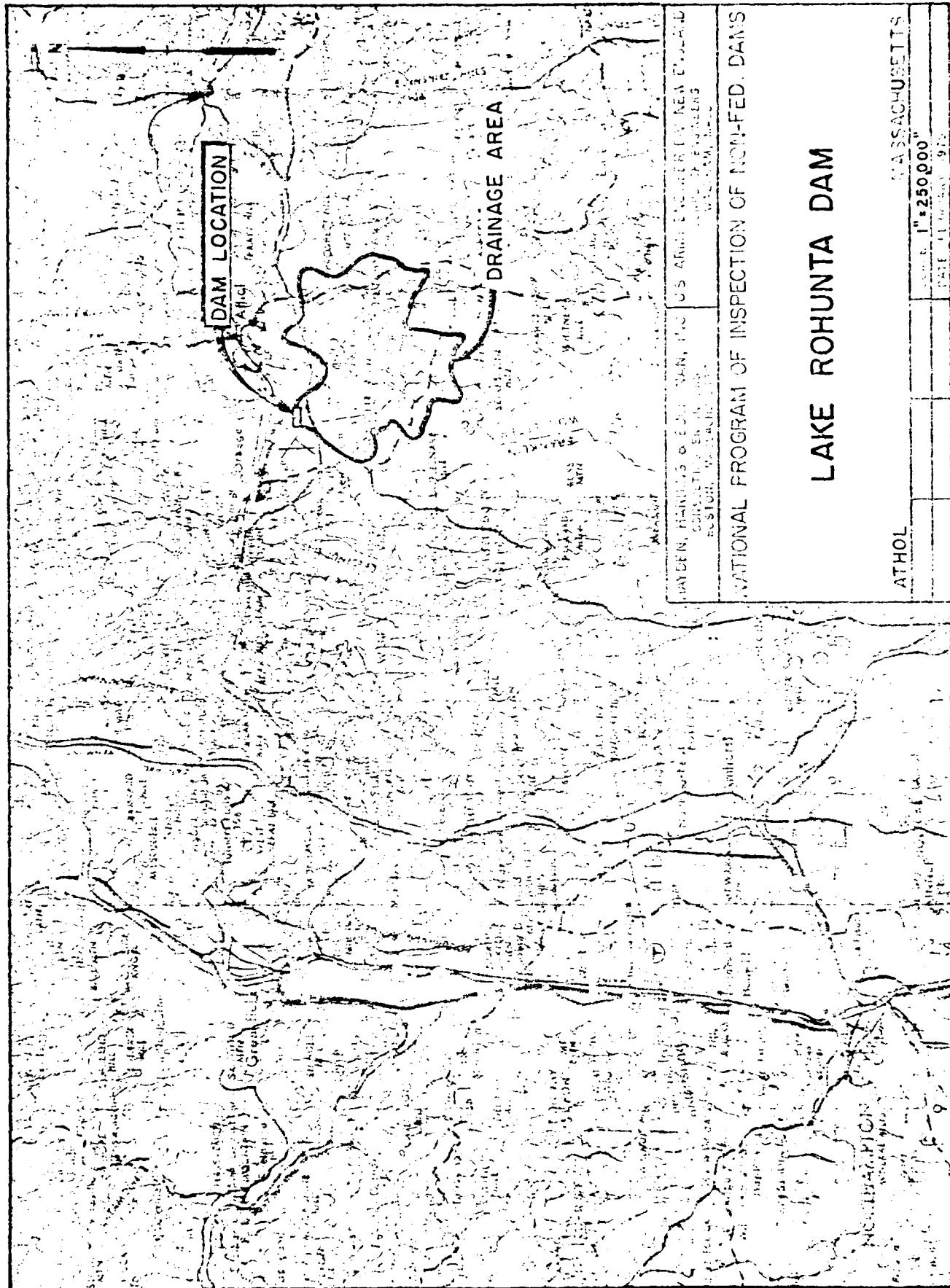
JOB 171472  
SUBJECT 200000  
CLIENT CORPS

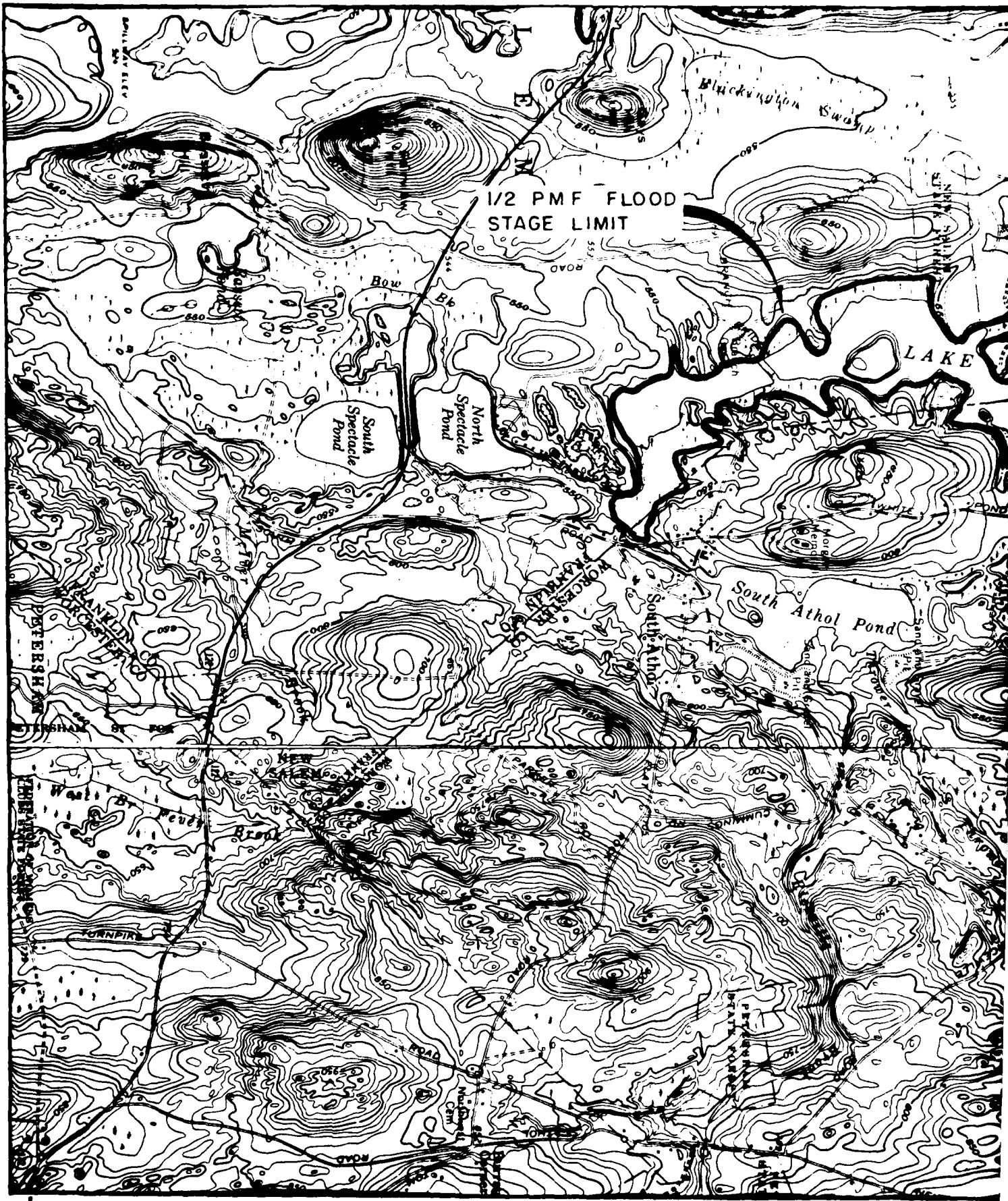


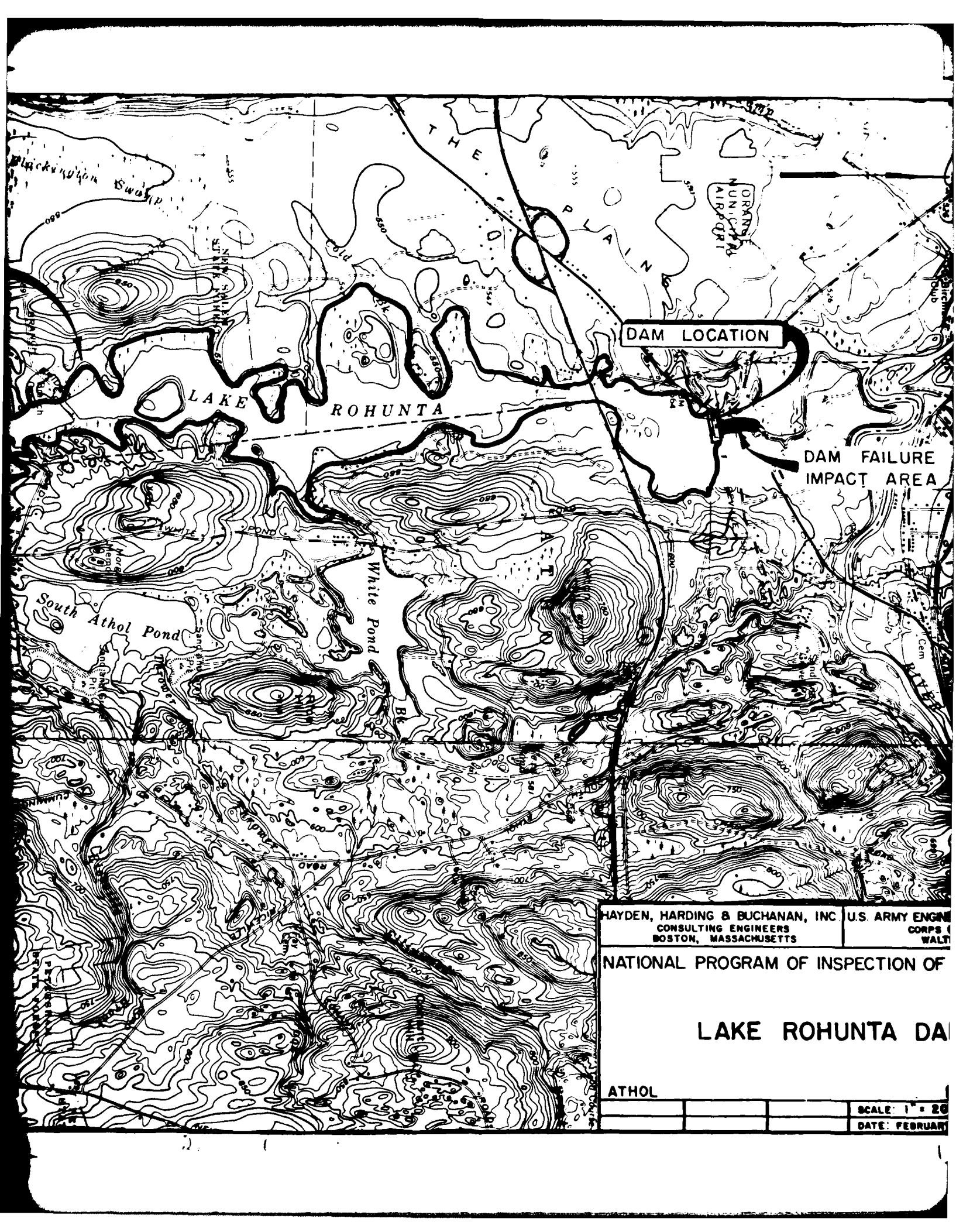
$Q$ , cfs spillway (w/flash boards)

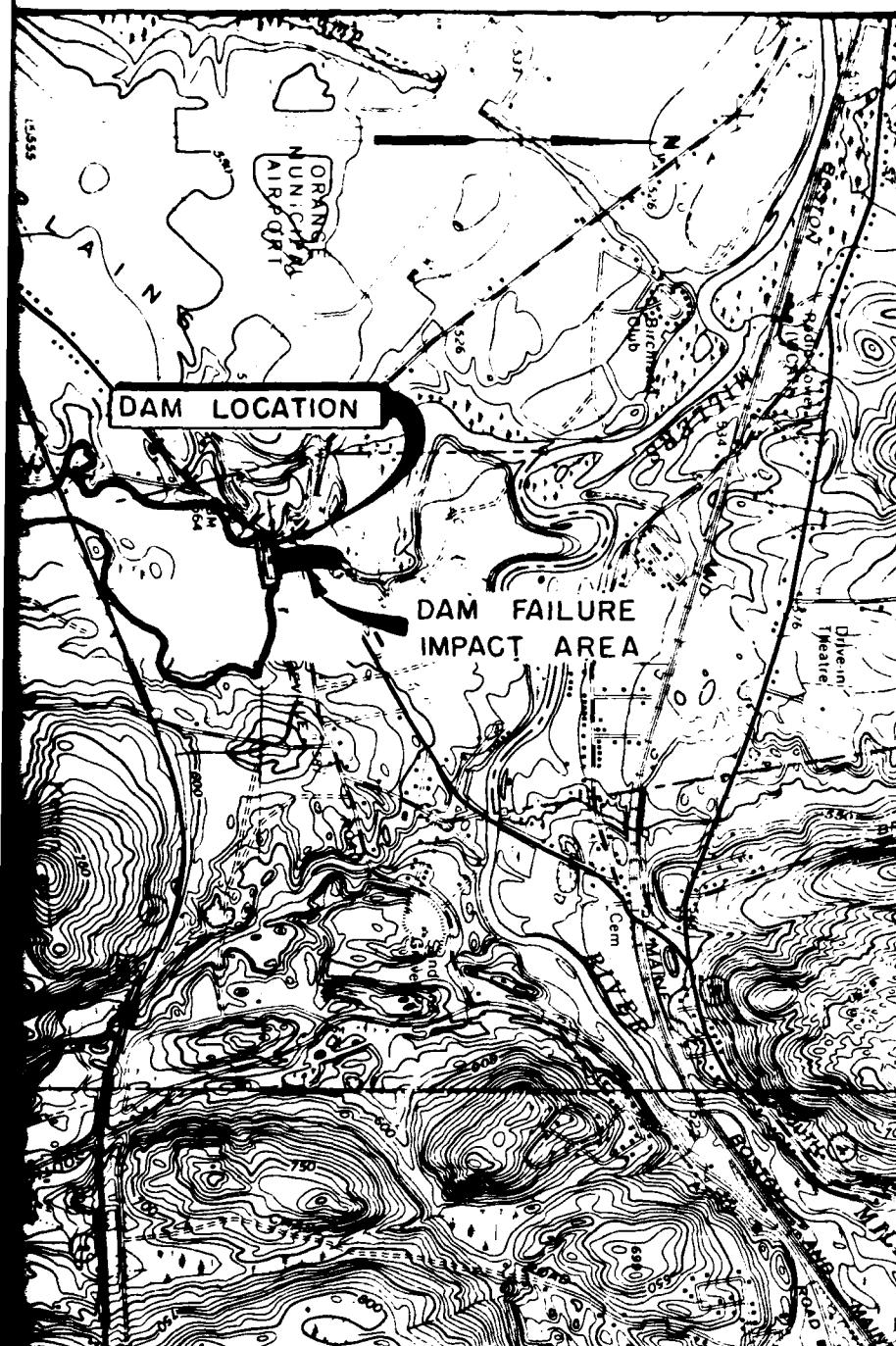


$Q$ , cfs over top dam









HAYDEN, HARDING & BUCHANAN, INC. U.S. ARMY ENGINEER DIV. NEW ENGLAND  
CONSULTING ENGINEERS CORPS OF ENGINEERS  
BOSTON, MASSACHUSETTS WALTHAM, MASS.

## NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

## NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

## LAKE ROHUNTA DAM

## ATHOL

## **MASSACHUSETTS**

SCALE: 1" = 2000

DATE: FEBRUARY, 1979.

APPENDIX E

INFORMATION AS CONTAINED IN THE  
NATIONAL INVENTORY OF DAMS

DATE  
ILME